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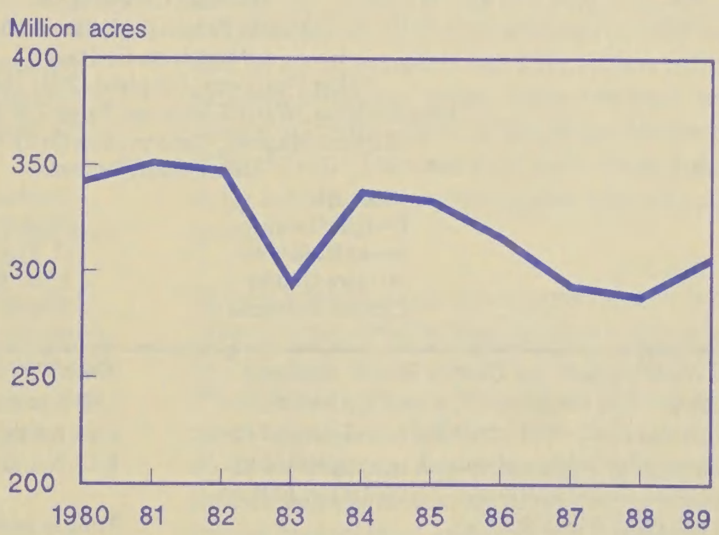
Agricultural Resources: Cropland, Water, and Conservation

Situation and Outlook Report



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Summary

Cropland used for crops (harvested, failed, and summer fallowed) rebounded from last year's record low, but remains below the highs of the late 1970's and early 1980's. Cropland used for 1989 crops is estimated at 342 million acres, up 14 million from last year, but down from the 1981 peak of 387 million. Harvested cropland is estimated at 306 million acres, up 18 million from a year ago. Crop failure is expected to cause farmers to abandon harvest on over 9 million acres, about 30 percent above the average of the last 20 years, but 1 million less than last year. Summer fallowed land, located mainly in the 17 Western States, is estimated at 27 million acres, down 3 million from 1988.

Except for the Delta States, all regions expanded acreage of cropland used for crops. The Corn Belt and Lake States regions showed gains in their shares of acreage used for crops relative to other regions, while the Northeast, Delta States, Southern Plains, and Pacific had relative losses.

Harvested acreage of wheat, corn, soybeans, and sorghum are all expected to be up in 1989. The total of these increases roughly equals the reduction in acres idled under Federal programs. More base acres of cotton were idled in 1989 than in 1988, and 2.4 million fewer acres are expected to be harvested.

Last year's drought reduced the index of crop production per acre to its lowest level since 1983. Declines occurred in five regions, and were especially severe in the Corn Belt, Lake States, and Northern Plains. The Southeast, Pacific, and Delta States regions had the largest gains in crop production per acre.

About 59 million acres were idled by Federal programs this year, 19 million less than last year. Land idled in annual programs totalled a little over 29 million acres, its lowest level since 1984 and about 24 million less than 1988. Participation in the Conservation Reserve Program (CRP) rose by more than 5 million acres, reaching a cumulative total of 29.6 million.

Dry top- and subsoil conditions in the western Corn Belt and Central Plains persisted this spring, forcing producers to gamble on timely precipitation or alter their planting decisions. Except for a few pockets of drought, topsoil moisture was replenished by rainfall late in the season, decreasing reliance on subsoil moisture. However, subsoil moisture is still near the low levels that led to this year's drought in most of the West and Northern Plains.

Irrigated acreage is estimated at 50.4 million acres, up 1.7 million from last year and the highest since 1981. Lower annual crop set-aside requirements, higher commodity prices, and improved water supply in the Northwest account for the increase. About 60 percent of this acreage depends on ground water sources; 20 percent on reservoirs; and another 20 percent on streams.

Most irrigators relying on reservoirs had sufficient water this season, since reservoir levels were adequate in most States. Some shortages were expected in Nevada, California, and Montana. An early snowpack melt raised reservoir levels by the start of the irrigation season, but left little snowpack for summer streamflow. Irrigators relying only on streamflow had limited supplies in most Western areas. Producers faced with either streamflow or reservoir water shortages likely substituted more expensive ground water or experienced decreased yields.

USDA agencies and programs are addressing water quality concerns. The Soil Conservation Service (SCS) has given its field offices updated guidance on protecting and improving water quality; the Cooperative Extension Service has pushed forward programs to help farmers understand how their land use, chemical use, and waste disposal can affect water quality; and USDA research agencies have expanded their efforts to estimate agriculture's potential and actual damage to surface and ground water, and to examine damage reduction techniques.

Soil conservation programs continue to reduce erosion and improve water quality. Enrollment in the CRP increased to 30.6 million through the February signup, including that to be retired in 1990. Establishing permanent cover on these acres will likely reduce average erosion by 20 tons per acre each year. About 88 percent of the acreage is treated with grass cover, 6 percent with tree plantings, and 5 percent for wildlife habitat. CRP expenditures for 1989 include $1.2 billion for rental payments and $547 million for cost-sharing to establish permanent cover. These two items represent more than 60 percent of total USDA conservation expenditures ($2.8 billion). State and local government funds are also being used to promote soil conservation and protect water quality.

Conservation Compliance requires farmers to have an approved conservation plan for their highly erodible fields by January 1, or lose eligibility for USDA program benefits. The SCS has approved plans for about 89 percent of the acres subject to compliance. Compliance requirements for 40-45 million acres may be met by CRP enrollment. Compliance on other land will rely heavily on conservation tillage, residue management, and cropping practices. Use of conservation tillage, which has leveled off since 1986, may again increase as farmers move toward compliance.

Cropland

Acreage Rebounds from 1988

About 342 million acres are expected to be used for crops in 1989, up 14 million (4 percent) from last year (table 1). After peaking at 387 million in 1981, when no acreage was idled under Federal programs, crop acreage trended downward through 1988. The decline was mainly due to increased farmer participation in Federal programs aimed at limiting crop production or soil erosion. In 1989, land idled by Federal programs declined 24 percent from 1988 and, following the usual inverse relationship, cropland increased sharply.

Farmers idled nearly 59 million acres in 1989, 19 million less than in 1988 (table 1, fig. 1). This year's sharp decrease resulted from 24 million fewer acres idled in annual crop programs, moderated by a 5-million-acre increase in enrollment in the Conservation Reserve Program (CRP).

The decline in acreage idled by annual programs was partially due to smaller acreage reduction requirements for corn, sorghum, barley, and wheat. Lower target prices and higher market prices for most program crops also reduced producers' program participation.

Farmers intend to harvest 305 million acres of the 19 principal crops, which together with minor crops may raise total harvested acres in 1989 to nearly 317 million. More than 11 million acres are estimated to be double cropped. After allowing for double cropping, harvested cropland is expected to total 306 million acres, 18 million above last year but 45 million below the 1981 record. Because harvesting is still underway in many areas, these estimates will likely change.

Nearly 27 million acres were summer fallowed in 1989, down more than 3 million from 1988 (tables 1 and 2). No doubt some land normally summer fallowed is being contracted into the CRP, which accounts for the decline in summer fallowed land since 1987.

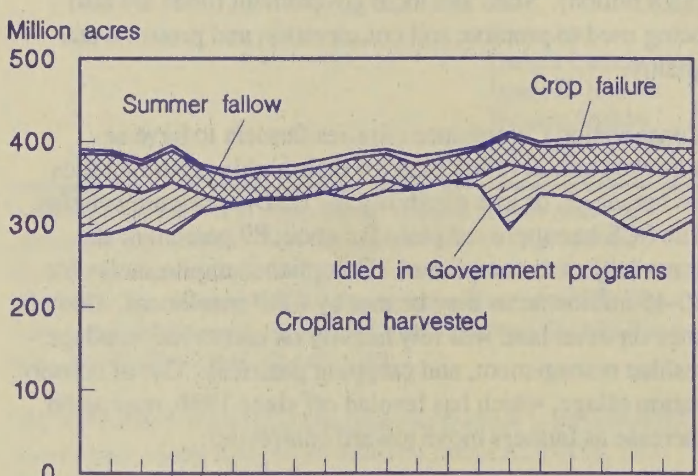
Drought impacts (especially on wheat) have contributed to crop failure, now estimated at more than 9 million acres, 2.9 percent of the planted acreage. Crop failure has declined from 1988, when severe drought devastated several regions,

Table 1--Major uses of U.S. cropland 1/

Cropland	1969	1979	1982	1983	1984	1985	1986	1987	1988	1989 2/
					Million acres					
Cropland used for crops	333	378	383	333	373	372	357	331	328	342
Cropland harvested 3/	286	340	347	294	337	334	316	293	288	306
Cropland failure	6	6	5	5	6	7	9	6	10	9
Cultivated summer fallow	41	32	31	34	30	31	32	32	30	27
Cropland idled by all Federal programs	58	13	11	78	27	31	48	76	78	59
Annual programs	50	13	11	78	27	31	46	60	53	29
Long-term programs	8	0	0	0	0	0	2	16	25	30
Total, specified uses 4/	391	391	394	411	400	403	405	407	406	401

1/ Includes the 48 conterminous States. 2/ Preliminary. 3/ An acre double cropped is counted as one acre. 4/ Does not include cropland pasture or idle land not in Federal programs but normally included in the total cropland base.

Figure 1
Major Uses of U.S. Cropland



but remains about the same as in 1986, when drought was also a problem, particularly in the Southeast and Southern Plains.

Current crop failure exceeds the average of the last 20 years by over 30 percent. The impacts of this year's drought on crop failure and crop yields will become more evident as harvesting proceeds.

Cropland used for crops in 1990 likely will continue the increase begun this year, when it rebounded from the 1988 low of 328 million acres. U.S. agricultural exports have maintained their high level, stocks of many crops have declined, and 1989 production relative to acres planted has been cut by adverse weather. All of these factors should boost U.S. market prices.

Table 2--Cropland used for crops in 1989 and 1988-89 change, by region

Region	Cropland harvested	Crop failure	Summer fallow	Total	Share of all cropland used for crops
	Million acres				Percent
Northeast	11.7	0.2	-	11.9	3.5
Lake States	34.8	0.5	-	35.3	10.3
Corn Belt	80.8	1.4	-	82.2	24.1
No. Plains	71.9	2.5	13.9	88.3	25.8
Appalachian	16.6	0.1	-	16.7	4.9
Southeast	10.7	0.2	-	10.9	3.2
Delta States	14.5	0.5	-	15.0	4.4
So. Plains	24.7	2.3	1.4	28.4	8.3
Mountain	24.9	1.1	8.8	34.8	10.2
Pacific	15.3	0.3	2.5	18.1	5.3
United States 2/	305.9	9.1	26.6	341.6	100.0
	1988-89 Change				
Northeast	0.0	0.1	0.0	0.1	
Lake States	2.5	-0.6	0.0	1.9	
Corn Belt	5.7	0.3	0.0	6.0	
No. Plains	6.7	-1.5	-2.1	3.1	
Appalachian	0.8	-0.1	0.0	0.7	
Southeast	0.6	-0.1	0.0	0.5	
Delta States	-0.9	0.1	0.0	-0.8	
So. Plains	0.3	0.4	-0.5	0.2	
Mountain	2.4	-0.2	-0.7	1.5	
Pacific	0.2	0.2	0.1	0.5	
United States 2/	18.3	-1.4	-3.2	13.7	

Cropland used for crops 1/ = Cropland harvested + Crop failure + Summer fallow + Total.

- = None or fewer than 100,000 acres.

1/ Preliminary. Based on farmers' harvest intentions. 2/ Includes the 48 conterminous States. Fewer than 200,000 acres were used for crops in Alaska and Hawaii. Breakdown may not sum to totals due to rounding.

Corn Belt Farmers Use 6 Million More Acres

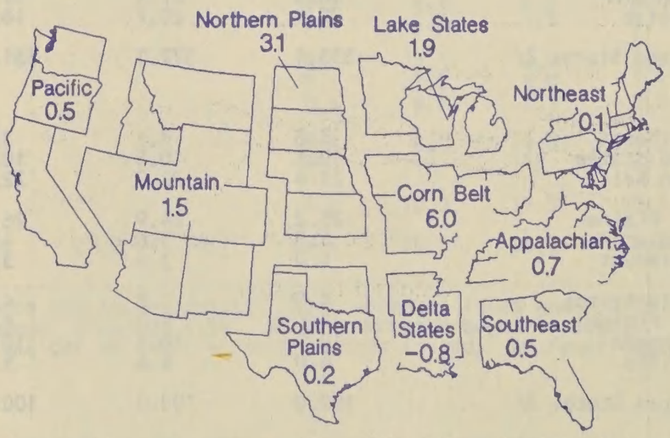
Cropland used for crops in 1989 is higher in 9 of the 10 farm production regions than last year. Only the Delta States region has less cropland used for crops than in 1988. Cropland in the Corn Belt is expected to total 82.2 million acres, about 6 million (8 percent) more than in 1988 (table 2, fig 2).

While sharply higher in 1988 and up again in 1989, Corn Belt acreage remains below that of many years in the late 1970's and early 1980's, when the number of acres idled under Federal programs was relatively low. Corn Belt farmers idled 5.4 million fewer acres under Federal programs this year than in 1988. A major part of the Corn Belt acreage increase can be attributed to additional acres planted to program crops: corn went up 3.1 million; wheat, 1.3 million; and soybeans, 1.0 million.

Comparing regional changes in cropland harvested reveals some notable changes in other regions. The Northern Plains shows the largest gain: 6.7 million acres. Estimated decreases in crop failure and summer fallowed land partially mask the total change in cropland used for crops. The 1989 rise in CRP land (1.9 million acres) may account for the large change in summer fallow.

A larger increase in cropland might be expected in the Southern Plains, given the low 1989 acreage reduction requirement for wheat. However, an increase in crop failure of 0.4 million acres constitutes this region's most significant change from 1988. The region accounts for about 25 percent of the nation's estimated crop failure in 1989, and has the largest regional increase.

Figure 2
Corn Belt Continues Largest Increase in Cropland Used for Crops during 1988-89



In million acres.

Corn Belt Continues To Increase Regional Share

Only two regions boosted their regional share of the nation's cropland in 1989: that in the Corn Belt climbed 0.4 percentage point to 24.1, and that of the Lake States increased by 0.3 percentage point to 10.3 (table 2). Although the Corn Belt increase continues the trend that has prevailed in this region during most of the 1980's, the Lake States rise constitutes a recovery to its 1986 regional share.

Regional shares for the Delta States, Southern Plains, Pacific, and Northeast decreased slightly. The Appalachian, Southeast, Northern Plains, and Mountain regions maintained their shares.

Comparing regional shares since 1983 provides no clear evidence of any trend in changes between regions (table 3). The Corn Belt alone demonstrates a substantial gain—from 21.4 percent in 1983 to 24.1 percent in 1989, while the Pacific, Mountain, Southeast, Delta States, and (perhaps) Northeast are losing. The Northern Plains region shows a slight gain but the Lake States, Southern Plains, and Appalachian regions have about the same regional share as in 1983.

Changes in regional shares are closely related to acres idled among regions and the subsequent number of previously idled acres returned to production as commodity programs change over time. However, the long-term nature of the CRP restricts the return of the CRP-idled acreage in the near future. Acreage changes by nonparticipants in Federal programs also varied among regions.

Idled Acreage Down Sharply

About 58.9 million cropland acres were idled under Federal programs this year (table 4), including lands enrolled in annual acreage reduction programs (including the 0/92 and 50/92 programs) and in the CRP through the February 1989 signup. The total excludes: (1) land to be idled by the CRP in the 1990 crop year; and (2) land which is neither cultivated nor idled under Federal programs. Results of the August 1989 CRP signup are not yet available.

About 50 percent—29.2 million acres—of the 1989 idled acreage is in annual Federal acreage reduction programs; the remainder is enrolled in the CRP. Acreage idled by all annual programs declined about 24 million acres for all program crops from 1988 to 1989 (table 5).

However, the 3.4 million additional base acres bid into the CRP offset part of the annual program decrease. Total net base acreage idled in 1989 decreased 20.7 million from a year earlier. (The difference between the 58.9 million total in table 4 and the 48.1 million total in table 5 represents nonbase acres idled by the CRP in 1986-89).

Base and nonbase acreage in the CRP remains idle for the full 10-year life of the CRP contract. Base acreage in the

Table 3--Cropland used for crops and change in acreage, by region

Region	1983	1985	1987	1989 1/	Change 1983-85	Change 1985-87	Change 1987-89
				Million acres			
Northeast	12.8	13.3	12.3	11.9	0.5	-1.0	-0.4
Lake States	33.8	39.0	33.3	35.3	5.2	-5.7	2.0
Corn Belt	71.4	85.3	73.7	82.2	13.9	-11.6	8.5
No. Plains	84.0	92.6	87.2	88.3	8.6	-5.4	1.1
Appalachian	16.6	18.7	16.3	16.7	2.1	-2.4	0.4
Southeast	13.2	13.3	10.3	10.9	0.1	-3.0	0.6
Delta States	16.2	17.7	15.3	15.0	1.5	-2.4	-0.3
So. Plains	28.7	34.1	28.2	28.4	5.4	-5.9	0.2
Mountain	36.3	37.4	35.9	34.8	1.1	-1.5	-1.1
Pacific	20.1	20.7	18.5	18.1	0.6	-2.2	-0.4
United States 2/	333.1	372.1	331.0	341.6	39.0	-41.1	10.6
				Percent share of U.S. total			
Northeast	3.8	3.6	3.7	3.5	1.3	2.4	-3.8
Lake States	10.1	10.5	10.1	10.3	13.3	13.9	18.9
Corn Belt	21.4	22.9	22.3	24.1	35.6	28.2	80.2
No. Plains	25.2	24.9	26.3	25.8	22.1	13.1	10.4
Appalachian	5.0	5.0	4.9	4.9	5.4	5.8	3.8
Southeast	4.0	3.6	3.1	3.2	0.3	7.3	5.7
Delta States	4.9	4.8	4.6	4.4	3.8	5.8	-2.8
So. Plains	8.6	9.2	8.5	8.3	13.8	14.4	1.9
Mountain	10.9	10.1	10.8	10.2	2.8	3.6	-10.4
Pacific	6.0	5.6	5.6	5.3	1.5	5.4	-3.8
United States 2/	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Preliminary. 2/ Includes the 48 conterminous States. Fewer than 200,000 acres were used for crops in Alaska and Hawaii. Breakdown may not sum to totals due to rounding.

Table 4--Cropland idled under Federal acreage reduction programs, by region

Region	1969	1979	1982	1983	1984	1985	1986	1987	1988	1989 1/
					Million acres					
Northeast	1.5	0.1	0.1	1.0	0.1	0.2	0.5	0.9	0.9	0.6
Lake States	6.4	0.9	0.7	8.0	1.6	2.1	4.0	7.0	6.8	4.6
Corn Belt	13.0	1.0	1.2	17.9	2.8	3.8	8.5	15.3	13.9	8.5
No. Plains	15.4	5.5	3.6	20.9	9.5	10.1	14.2	19.7	20.8	14.8
Appalachian	3.5	0.1	0.1	2.6	0.4	0.5	1.3	2.7	3.0	2.3
Southeast	3.7	0.2	0.2	2.3	0.5	0.7	1.3	3.0	3.2	3.0
Delta States	1.0	0.1	0.6	3.5	1.3	1.9	2.4	3.6	3.1	3.0
So. Plains	7.9	2.8	2.3	12.8	5.7	5.9	8.3	11.7	12.0	10.1
Mountain	4.4	1.9	1.7	6.1	3.9	3.9	5.4	8.7	10.2	8.8
Pacific	1.2	0.4	0.6	2.9	1.2	1.6	2.2	3.5	3.8	3.0
United States 2/ 3/	58.0	13.0	11.1	77.9	27.0	30.7	48.2	76.2	77.6	58.9
					Percent of U.S. total 4/					
Northeast	2.6	0.8	0.6	1.3	0.4	0.7	1.0	1.2	1.2	1.0
Lake States	11.0	6.9	6.4	10.3	5.8	6.8	8.3	9.2	8.8	7.8
Corn Belt	22.4	7.7	10.5	23.0	10.4	12.4	17.6	20.1	17.9	14.4
No. Plains	26.6	42.3	33.3	26.8	35.2	32.9	29.5	25.9	26.8	25.1
Appalachian	6.1	0.8	1.2	3.3	1.3	1.6	2.7	3.5	3.9	3.9
Southeast	6.3	1.5	1.4	3.0	1.8	2.3	2.7	3.9	4.1	5.1
Delta States	1.7	0.8	5.2	4.5	4.7	6.2	5.0	4.7	4.0	5.1
So. Plains	13.6	21.5	21.1	16.4	21.1	19.2	17.2	15.4	15.5	17.1
Mountain	7.6	14.6	15.1	7.8	14.4	12.7	11.2	11.4	13.1	14.9
Pacific	2.1	3.1	5.2	3.7	4.6	5.2	4.6	4.6	4.9	5.1
United States 2/	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Preliminary. 2/ Includes the 48 conterminous States. Because of rounding, regional data may not sum to U.S. totals. 3/ Includes cropland idled by 0/92 and 50/92 programs in 1986 through 1989. Also includes 2.0 million acres enrolled in the Conservation Reserve Program in 1986, 15.7 million acres in 1987, 24.5 million acres in 1988, and 29.6 million acres in 1989. Another 1.0 million acres are enrolled in the 1990 program. 4/ Developed from unrounded estimates.

Table 5--Base acreage idled under Federal acreage reduction programs, United States

Program and crop	1969	1979	1982	1983	1984	1985	1986	1987	1988	1989 1/
					Million acres					
Annual programs:										
Corn	27.2	2.9	2.1	32.2	3.9	5.4	14.2	23.2	20.5	10.0
Sorghum	7.5	1.2	0.7	5.7	0.6	0.9	2.9	4.1	3.9	2.8
Barley	4.4	0.7	0.4	1.1	0.5	0.7	2.0	3.0	2.8	2.1
Oats			0.1	0.3	0.1	0.1	0.5	0.8	0.3	0.3
Wheat	11.1	8.2	5.8	30.0	18.6	18.8	21.0	23.9	22.5	9.5
Cotton			1.6	6.8	2.5	3.6	4.0	3.9	2.2	3.4
Rice			0.4	1.8	0.8	1.2	1.5	1.6	1.1	1.2
Total, annual programs 2/	50.2	13.0	11.1	77.9	27.0	30.7	46.2	60.5	53.2	29.2
Conservation Reserve Program (CRP) 3/:										
Corn							0.2	2.3	2.8	3.4
Sorghum							0.2	1.2	1.9	2.1
Barley							0.1	1.1	1.9	2.3
Oats							0.1	0.5	0.9	1.1
Wheat							0.6	4.2	7.1	8.8
Cotton							0.1	0.7	1.0	1.2
Rice							4/	4/	4/	4/
Total, CRP 2/							1.2	10.0	15.5	18.9
Total base acres idled 2/	50.2	13.0	11.1	77.9	27.0	30.7	47.4	70.5	68.8	48.1

1/ Preliminary. 2/ Because of rounding, crop acreages may not sum to the totals. Base acreages idled under 0/92 and 50/92 programs in 1986 through 1989 are included in the annual programs data. 3/ This program began in 1986. Small acreages of peanut and tobacco base were also bid into the CRP in addition to the crops listed. 4/ Fewer than 50,000 acres.

CRP is preserved as base and will increase effective base acreage at the end of the CRP contract (table 6).

Participation in the 1990 commodity programs is expected to remain substantial as many producers continue to rely on deficiency payments to supplement their production returns. Additional enrollments in the CRP will also remove more land from production. Another 1 million acres were contracted for 1990 during the February 1989 signup.

A comparison of the net change of fewer base acres of individual crops idled by annual programs and more base acres in the CRP in 1988 and 1989 reveals some major crop shifts. Net wheat base acreage idled fell by 11.3 million acres (38 percent), corn by 9.9 million (42 percent), sorghum by 0.9 million (16 percent), and barley by 0.3 million (6 percent). Net cotton base acreage idled increased by 1.4 million acres (44 percent), and oats by 0.2 million (17 percent); rice was virtually unchanged from 1988.

Commodity Acreage Reduction Requirements

Feed Grains. Participants in the 1989 feed grain programs were required to idle at least 10 percent of their base acreage of corn, sorghum, and barley, down from 20 percent in both 1987 and 1988. Also, there was no paid land diversion (PLD) in 1989, whereas in 1988, corn, sorghum, and barley producers could idle another 10 percent of their base acreage in the PLD Program. The 1989 oats program required producers to idle just 5 percent of the base acreage, as in 1988.

Feed grain acreage idled in the 1989 program totals just over 15 million acres, down more than 12 million from last year. In addition to the annual program participation, nearly 9 million acres have been enrolled in the CRP—about 7 percent of the 1989 national feed grain base acreage of 119 million acres. Provisions of the 1990 feed grain program must be announced by September 30.

Wheat. For wheat, participating growers had to idle 10 percent of their base acreage in 1989, compared with 27.5 percent in 1987 and 1988. A total of 9.5 million acres was idled, down 13 million from last year. Also, 8.8 million acres were enrolled in the CRP for 1989, an increase of just 1.7 million acres from last year.

An additional option was recently added to the 1990 wheat program announced in May. As originally announced, participants would idle 5 percent of their base acreage, compared with 10 percent in 1989 and 27.5 percent in 1988. The added option will permit producers to plant up to 105 percent of their wheat base, but will require that wheat acreage used to compute deficiency payments be reduced by one acre for each acre above 95 percent of base. Therefore, if 105 percent of the wheat base is planted, producers will receive deficiency payments on 85 percent. The increased plantings cannot be used to build base, but, if acreage of other program crops are reduced to plant the added wheat, farmers will not lose base on those crops.

The 1990 target price for wheat will be $4.00 per bushel, down more than 2 percent from this year. The 1990 loan rate for wheat has been lowered 5 percent to $1.95 per bushel.

Cotton and Rice. For cotton, the 1989 acreage reduction requirement was 25 percent—double the 1988 requirement and equal to the requirement in 1986 and in 1987. For rice, 25 percent of base had to be idled, as in 1987. A total of 3.4 million acres of cotton were idled, up 1.2 million from 1988; 1.2 million acres of rice were idled, up 0.1 million from 1988. In addition, just 1.2 million cotton base acres and 8,361 rice base acres have been enrolled in the CRP for 1989 as of the February signup. Provisions of the upland cotton program must be announced by November 1.

Between 1988 and 1989, total acreage idled (under annual programs and the CRP) decreased in all farm production regions (table 4). Proportionately, the greatest decrease occurred in the Corn Belt, where nearly 40 percent less acreage was idled in 1989 than a year earlier. The Corn Belt decrease in annual program participation was even greater because an additional 0.7 million acres were enrolled in the CRP in 1989.

Participation in the annual crop programs declined sharply as higher commodity market prices and lower target prices discouraged many producers from signing up. Cropland idled in the Northeast, Lake States, Northern Plains, Southeast, Appalachian, and Pacific regions dropped more than 20 percent this year. Decreases in the other regions ranged from nearly 16 percent in the Southern Plains and about 14 percent in the Mountain region to 3 percent in the Delta States. In contrast, enrollment in the CRP rose in all regions, and the 1988-89 increase in base acreage idled by the CRP totalled 3.4 million acres (table 5).

Less Slippage in Commodity Programs

In recent years, acreage reduction programs appear to have become more effective in reducing the acreage actually cropped. From 1981 (when no land was idled under Federal programs) to 1983, 78 million acres were idled by Federal programs nationally, but cropland used for crops declined by just 54 million acres. This type of "slippage" can occur if nonparticipating farmers plant additional land in expectation of higher prices while participating farmers are idling land.

Although 47 million fewer acres were idled in 1985 than in 1983, crop acreage expanded by only 39 million. In this case, when set-aside requirements of programs are reduced: (1) not all of the available land is cropped; or (2) the land no longer idled under program provisions is planted in place of some other land.

Figure 3
Change in Land Idled by Government Programs and Cropland Used for Crops

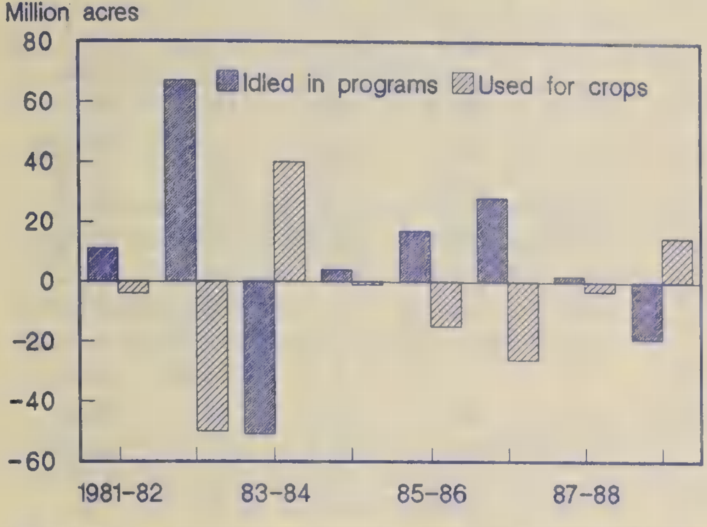


Fig. 3 illustrates year-to-year changes from 1981 to 1989 in land idled under Federal programs and used for cropland. In 1989, acreage idled by annual and CRP programs declined by 18.7 million, while cropland climbed by just 15.2 million. Generally, when acreage idled by programs increased, cropland did not usually decrease in like amount; conversely, when acreage idled by programs fell, cropland did not show a corresponding expansion.

In recent years, the changes in cropland acreage have more closely reflected changes in idled acreage. This is largely the result of the commodity programs' attractiveness to producers and their higher participation in programs. The increasing percentage of program crops planted on complying base acres demonstrates this upward trend in participation (table 6).

Crops Planted and Base Acreage of Program Crops

Total base acreage of program crops—wheat, feed grains, cotton, and rice—reached a peak for the decade in 1985 at 240.3 million acres (table 6). However, since 1986 the CRP has cut the effective base acreage in each subsequent crop year, until in 1989 it is lower than in any other year in the decade. (No Federal programs idling land existed in 1980 and 1981.)

Complying base acreage or the portion of the effective base acreage controlled by producers participating in annual commodity programs varies for a number of reasons, including the attractiveness of the program provisions and the outlook for crop prices. The proportion of the effective base complying in 1989—76.3 percent—is lower than in 1986-88, but higher than in 1982-85.

Complying base acreage minus the acreage required to be idled (set aside) equals maximum acreage that program participants may plant. The complying base actually planted is less than the complying base minus program set-aside in each year. However, the complying base planted is also considerably less than the total acreage of program crops planted by program participants and nonparticipants. It rose from 33 percent of program crops planted in 1982 to 71 percent in 1987, indicating considerable production of program crops outside the Federal programs.

Acreage of Most Major Crops Up in 1989

Harvested acreages of corn, wheat, sorghum, and soybeans are expected to rise in 1989, while the acreage of cotton is estimated to fall (table 7). All cropland harvested is expected to be up 18.3 million acres from a year earlier (table 8).

The increase in harvested acreage can be explained mainly by the decline in land idled in Federal programs. The land idled by Federal programs has fallen in all regions from 1988, and the acreage of cropland harvested is estimated up in all regions except the Delta States. The decrease in the Delta States can be largely attributed to poor weather which prevented some soybean planting and increased estimated failure of soybeans which were planted.

Harvested corn acreage in 1989 is forecast at 65.2 million, up 7 million from a year earlier. Substantial gains are likely in the Corn Belt (3.1 million acres), Lake States (2.1 million), and Northern Plains (1.3 million).

Wheat acreage harvested in 1989 is estimated at 62.7 million acres, up 9.5 million from a year ago and up 0.7 million acres from the 1983-87 average. Had adverse weather not intervened, the expansion would likely have been considerably higher. The expected increase results from 11.3 million fewer acres of wheat base idled. All regions show gains in harvested acres, particularly the Northern Plains (3.7 million acres), Mountain (1.6 million), and Corn Belt (1.3 million) regions.

Sorghum acres harvested for grain in 1989 are estimated at 10.5 million, up 1.5 million from a year earlier. The Southern and Northern Plains likely will demonstrate the largest gains, of 0.7 million and 0.5 million acres, respectively.

Soybeans are expected to be harvested on 59.1 million acres in 1989, about 1.7 million more than in 1988. Except for the Delta States and Northern Plains, soybean acreage is up in all the regions that normally produce this crop. Part of the gain can be attributed to this year's special program provisions, which allowed farmers to plant soybeans on a portion of the base acres of other program crops while preserving the replaced crop base for future years.

Harvested acreage of cotton is expected to be 9.5 million in 1989, down 2.4 million from 1988. Land idled in the annual cotton program rose by 1.2 million acres, and another 0.2 million more acres of cotton base were enrolled in the CRP

Table 6--Principal and program crops planted, total base acreage, and other Federal program acreage statistics and relationships

Item	1982	1983	1984	1985	1986	1987	1988	1989 1/
	Million acres							
Principal crops planted	358.6	309.4	345.0	342.1	327.2	304.7	308.2	316.7
Program crops planted	222.3	189.3	215.4	216.9	204.3	185.1	182.5	195.7
Total base acreage of program crops	229.9	229.8	234.4	240.3	235.0	236.4	239.2	239.2
Base acres in CRP 2/					1.2	10.0	15.5	18.9
Effective base acreage 3/	229.9	229.8	234.4	240.3	233.8	226.4	223.7	220.3
Complying base acreage	96.9	168.1	128.6	162.8	192.9	197.2	187.8	168.1
Annual program set-aside	11.1	77.9	27.0	30.7	46.2	60.5	53.2	29.2
Complying base minus set-aside	85.8	90.2	101.6	132.1	146.7	136.7	134.6	138.9
Complying base planted	73.7	79.8	88.0	116.1	135.5	131.6	125.0	NA
	Percent							
Effective base acreage as a percentage of principal crops planted	64.1	74.3	67.9	70.2	71.5	74.3	72.6	69.6
Complying base acreage as a percentage of effective base acreage	42.1	73.2	54.9	67.7	82.5	87.1	84.0	76.3
Complying base acreage as a percentage of program crops planted	43.6	88.8	59.7	75.1	94.4	106.5	102.9	85.9
Complying base planted as a percentage of program crops planted	33.2	42.2	40.9	53.5	66.3	71.1	68.5	NA

NA = Not available.

1/ Preliminiary. 2/ Program began in 1986. 3/ Total base acreage of program crops less base acres in CRP.

Table 7--Harvested acreage of major crops, by region 1/

Region	Corn			Sorghum			Wheat			Soybeans			Cotton		
	Average 1983-87	1988	1989	Average 1983-87	1988	1989	Average 1983-87	1988	1989	Average 1983-87	1988	1989	Average 1983-87	1988	1989
	Million acres														
Northeast	2.7	2.0	2.1	-	-	-	0.6	0.5	0.7	0.9	1.0	1.2	-	-	-
Lake States	10.9	8.3	10.4	-	-	-	3.4	3.0	3.5	6.3	6.4	6.5	-	-	-
Corn Belt	32.4	30.3	33.4	1.3	0.6	0.7	4.3	4.5	5.8	30.3	28.8	29.8	0.2	0.2	0.2
No. Plains	10.8	10.5	11.8	5.7	4.9	5.4	25.0	21.4	25.1	5.8	6.8	6.8	0.0	0.0	0.0
Appalachian	3.9	2.9	3.1	0.3	0.1	0.1	1.6	1.5	1.9	5.1	4.2	4.6	0.4	0.7	0.6
Southeast	1.7	1.1	1.2	0.3	0.1	0.1	1.5	1.1	1.4	3.8	2.4	2.8	0.6	0.9	0.8
Delta States	0.4	0.3	0.3	1.2	0.6	0.5	1.7	1.8	2.1	8.5	7.3	6.8	2.0	2.5	2.2
So. Plains	1.4	1.4	1.5	4.0	2.5	3.2	9.8	8.0	8.7	0.5	0.5	0.7	4.5	5.8	4.1
Mountain	0.9	1.0	1.2	0.5	0.3	0.5	10.0	8.1	9.7	-	-	-	0.4	0.6	0.6
Pacific	0.4	0.3	0.3	-	-	-	4.2	3.3	3.9	-	-	-	1.2	1.3	1.1
United States 2/	65.5	58.2	65.2	13.3	9.1	10.5	62.1	53.2	62.7	61.2	57.4	59.1	9.3	11.9	9.5

- = None or fewer than 500,000 acres.

1/ Corn and sorghum for grain. All 1989 acreages based on farmers' harvest intentions. 2/ Includes the 48 conterminous States. Because of rounding, regional acres may not sum to U.S. totals.

Table 8--Change in harvested acreage of major crops 1983-87 to 1989 and 1988 to 1989, by region 1/

Region	1983-87 to 1989						1988 to 1989					
	Corn	Sorghum	Wheat	Soybeans	Cotton	All cropland harvested	Corn	Sorghum	Wheat	Soybeans	Cotton	All cropland harvested
	Million acres											
Northeast	-0.6	-	0.1	0.3	-	-1.1	-	-	0.2	0.2	-	-
Lake States	-0.6	-	0.1	0.2	-	-1.1	2.1	-	0.5	0.1	-	2.5
Corn Belt	1.0	-0.6	1.5	-0.5	-	2.1	3.1	0.2	1.3	1.0	-	5.7
No. Plains	1.0	-0.3	0.1	1.0	-	0.1	1.3	0.5	3.7	-	-	6.7
Appalachian	-0.8	-0.2	0.3	-0.5	0.2	-0.7	0.2	-	0.4	0.4	-0.1	0.8
Southeast	-0.5	-0.2	-0.1	-1.0	0.2	-1.5	0.1	-	0.4	0.4	-0.1	0.6
Delta States	-0.1	-0.7	0.5	-1.8	0.2	-2.0	-	-	0.3	-0.5	-0.3	-0.9
So. Plains	0.1	-0.8	-1.1	0.2	-0.4	-2.4	0.1	0.7	0.7	0.2	-1.6	0.3
Mountain	0.3	-	-0.3	-	0.2	-0.8	0.2	0.2	1.6	-	-	2.4
Pacific	-0.1	-	-0.4	-	-0.1	-1.4	-	-	0.5	-	-0.3	0.2
United States 2/	-0.3	-2.8	0.7	-2.1	0.2	-8.8	7.0	1.5	9.5	1.7	-2.4	18.3

- = None or fewer than 100,000 acres.

1/ Corn and sorghum for grain. All 1989 acreages based on farmers' harvest intentions. Changes developed from unrounded estimates. 2/ Includes the 48 conterminous States.

for the 1989 crop year. This increased idling of cotton base accounts for about 58 percent of the anticipated reduction in cotton harvest. All regions that normally report cotton will likely have lower harvested acreage, particularly the Southern Plains, with a decline of 1.6 million acres.

Crop Production Per Acre Down Sharply in 1988

The U.S. index of crop production per acre of cropland used for crops was 106 (1977 = 100) in 1988, down from 122 in 1987 and the lowest since 1983 (table 9). But despite the sharp national decrease, 5 of the 10 farm production regions—those in the south and west—experienced increases, some quite substantial.

The Southeast registered a gain of 12 percent, followed by the Pacific (11 percent), Delta States (8 percent), Appalachian (5 percent), and Southern Plains (3 percent). The northern part of the country from the Mountain region east experienced large losses in productivity, largely due to the drought. Crop production per acre dropped by 33 percent in the Lake States and 30 percent in the Corn Belt. Other regions experiencing a decline in productivity included the Northern Plains (-22 percent), Mountain (-7 percent), and Northeast (-5 percent).

On a more positive note, crop production per acre of cropland used for crops in 1988 rose to all-time highs in the Southeast, Delta States, Southern Plains, and Pacific regions.

Exports Down Slightly, But Acreage Equivalent Continues To Grow

Exports of U.S. agricultural products in fiscal 1989 are forecast at 147 million tons, less than 1 percent below a year earlier. Reduced exports of wheat, flour, oilseeds, and oilseed products are expected, largely due to tight supplies and higher prices. A recent increase in forecast exports resulted primarily from improved prospects for coarse grain (corn and grain sorghum) exports which will nearly offset decreases in wheat and soybeans. Expected record coarse grain sales to the Soviet Union account for much of the gain.

The acreage equivalent of the 1988 exports is estimated at 121 million, up about 14 percent from 106 million in 1987 (table 10). This expansion, however, remains substantially below the high of 137 million estimated in 1980.

Acreage equivalents are estimated by dividing U.S. export volumes of individual commodities by respective per-acre yields. Because of the greatly reduced yields of 1988, the acreage equivalents of crops exported swelled.

The acreage equivalent of food grains exported in 1988 is estimated at 43 million, up about 2 percent from a year earlier. Feed grain exports are estimated to approximate the production of 34 million acres, up 14 million (70 percent) from 1987. Oil crops are expected to account for the equivalent of 26 million acres, cotton for 5 million, and other exported crops for 13 million.

Export equivalents in 1988 are expected to equal 41 percent of all acres harvested (table 10), compared with 35 percent in 1987. Again, it should be noted that the sharp increase in acreage equivalent of exports is largely due to decreased crop yields resulting from the severe drought of 1988.

Food grains represent 36 percent of total acreage equivalents in 1988, feed grains 28 percent, and oil crops 21 percent. Although the mix of exports has varied each year, the acreage equivalent of exports tended to increase during the 1970's, decrease from 1980 to 1985, and rise again since 1985 (fig. 4). The acreage equivalents of other crops exported have trended upward since the early 70's, although they have comprised a smaller percentage of exports since 1985.

Figure 4
Acreage Equivalents of U.S. Crops Exported

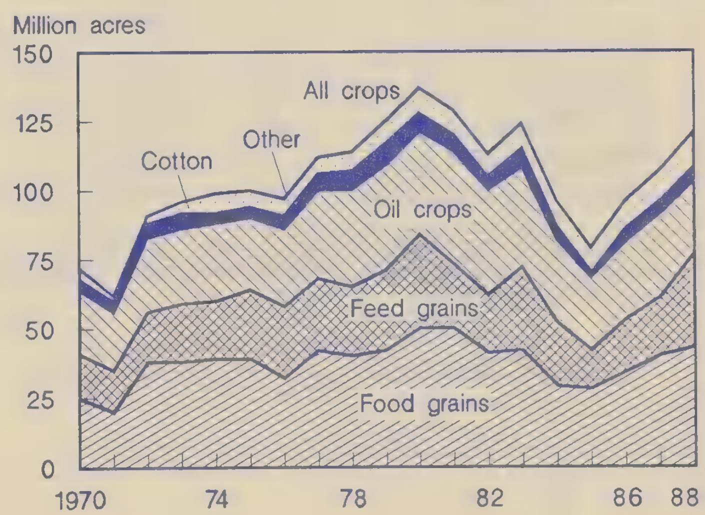


Table 9--Indices of crop production per acre of cropland used for crops, by region

Region	1969	1979	1982	1983	1984	1985	1986	1987	1988 1/
					1977 = 100				
Northeast	109	109	114	104	116	120	113	112	106
Lake States	86	105	114	101	110	114	114	119	80
Corn Belt	93	116	117	88	105	124	124	122	85
No. Plains	84	119	120	102	118	129	131	127	99
Appalachian	114	102	120	88	116	111	96	100	105
Southeast	113	120	133	122	129	135	122	139	155
Delta States	101	112	118	98	118	114	106	122	132
So. Plains	80	109	91	97	100	105	93	116	119
Mountain	92	107	116	110	107	104	112	124	115
Pacific	87	107	115	114	121	124	122	139	154
United States 2/	91	113	116	100	112	120	116	122	106

1/ Preliminary. 2/ Includes the 48 conterminous States.

Table 10--Acreage equivalents of U.S. crops exported, 1970-88 1/

Cropland	1970	1979	1982	1983	1984	1985	1986	1987	1988 2/
					Million acres				
All crops harvested 3/	293	348	362	306	348	342	325	302	297
Used for exports:									
Food grains	25	42	41	42	29	28	33	42	43
Feed grains	16	29	21	30	23	14	19	20	34
Oil crops	23	38	38	36	30	26	28	29	26
Cotton	4	8	5	7	5	2	5	4	5
Other crops	4	[illegible]	[illegible]	9	9	9	10	11	13
Total	72	125	113	124	96	79	95	106	121
					Percent exported 5/				
All crops harvested 4/	25	36	31	41	28	23	29	35	41
					Percent of total acreage equivalents 6/				
Used for exports:									
Food grains	35	34	36	34	30	35	35	39	36
Feed grains	22	23	19	24	24	18	19	19	28
Oil crops	32	30	34	29	31	33	29	27	21
Cotton	6	6	4	6	5	2	6	4	4
Other crops	5	6	7	7	10	12	11	10	11
Total	100	100	100	100	100	100	100	100	100

1/ For years beginning July 1 for 1970, and October 1 thereafter. 2/ Preliminary. 3/ Includes all cropland harvested plus acres double cropped during the calendar year. 4/ Acreage equivalents of exports as a percentage of all crops harvested.

Excess Capacity in U.S. Agriculture—How Much Remained in 1988?

Estimates of total long-run excess capacity in 12 major commodities have declined from a peak of nearly 7 percent in 1985 to nearly 4 percent in 1988 (fig. 5).[1] The 12 commodities are: wheat, corn, rye, barley, grain sorghum, oats, rice, tobacco, peanuts, cotton, soybeans, and dairy products. Annual excess capacity in these commodities declined from a high of nearly 12 percent in 1985 to less than 1 percent in 1988. Strengthened exports and the 1988 drought have reduced excess capacity in U.S. agriculture.

Excess capacity is defined as the difference between "commercial demand" and "potential supply" at current market prices.[2] Commercial demand is the value of production that can be cleared by the commercial market (domestic and foreign demand), plus what recipient countries would have purchased in the absence of any Government export programs. Commercial demand was adjusted to take into account exports under the Export Enhancement Program (EEP). Potential supply equals the value of actual production plus imports plus potential production from land idled by acreage reduction programs.

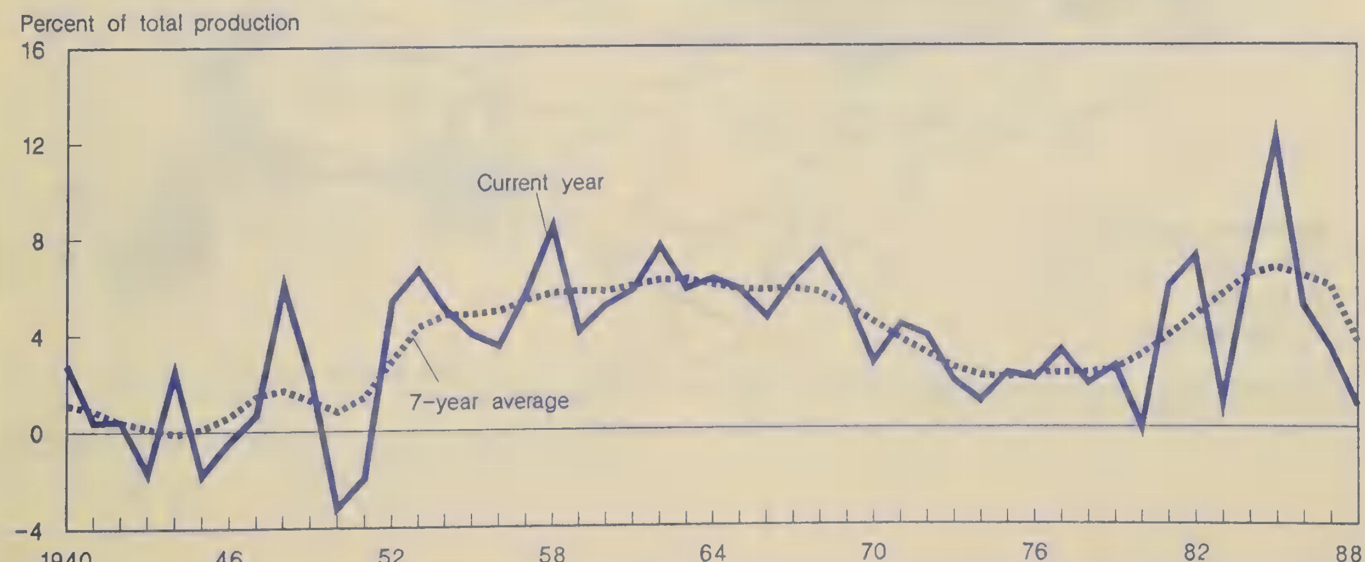
Excess capacity as measured here estimates the additional resources committed to agricultural production purely as a result of Government price and income support programs at current support levels, rather than free market forces. By definition, a free market has no excess capacity because the commitment of resources adjusts freely to maintain an equilibrium between output and demand. But Federal programs slow this resource adjustment, and thus generate excess capacity. Through their program decisions, Government policymakers help farmers and rural communities with the benefit of a steady income, reduce the risk of food shortages due to droughts or other hazards by marketing of Government-owned stocks, and protect farmers from unforseen fluctuations in domestic and international prices.

The potential production from acreage idled by Federal programs derives not only from the annual set-aside acreage, but also from a portion of the Conservation Reserve Program (CRP). The CRP idles cropland for 10 years to control erosion and production; the annual set-aside program, on the other hand, idles cropland simply to control production. Therefore, all of the crop base acres have been included in the potential supply computation (on the assumption that all of the crop program base acres now in the CRP will return to crop production to conserve the base), plus one-half of the CRP acreage neither planted to permanent use (trees) nor included in the crop program base acreage. This result estimates the CRP enrollment that will return to crop production at the end of the CRP contracts. This estimate is consistent with the findings of a survey asking participants about their plans for CRP lands when the contracts expire. The actual disposition of CRP lands beyond 1995 will depend on crop prices and program changes (such as base preservation when the CRP contracts end) at that time.

[1] The 7-year moving average in fig. 5 gives more weight to the center years of this series than to years away from the center. To calculate an average less than 3 years away from 1989 or 1940 (for example, 1987), we increased the weights.

[2] Dvoskin, Dan. "Excess Capacity in U.S. Agriculture: An Economic Approach to Measurement." Agricultural Economics Report No. 580. USDA, ERS. February, 1988.

Figure 5
Excess Capacity in 12 Commodities



Water Supply and Irrigation

A continuation of the 1988 drought affected major crop production regions this spring. A lack of winter and spring moisture reduced the Kansas wheat crop. Corn and soybean growers in the Corn Belt and Lake States had to gamble on timely rains and risk normal production investments, or adjust 1989 production plans.

Relying on adequate and timely precipitation for crop production is a risk that most farmers face; however, an increasing number of acres are irrigated. Irrigated acreage has grown by about 2 million acres this year, because some irrigated cropland was brought back into production due to lower set-aside requirements.

Water supplies at planting influence many producer decisions regarding planted crops, tillage operations, seeding rates, and other input applications. The realization of the production potential established by these decisions depends on the amount and timeliness of precipitation and many other factors. Available supplies of stored water may influence such decisions as the number of acres to be irrigated, and the timing and application of water.

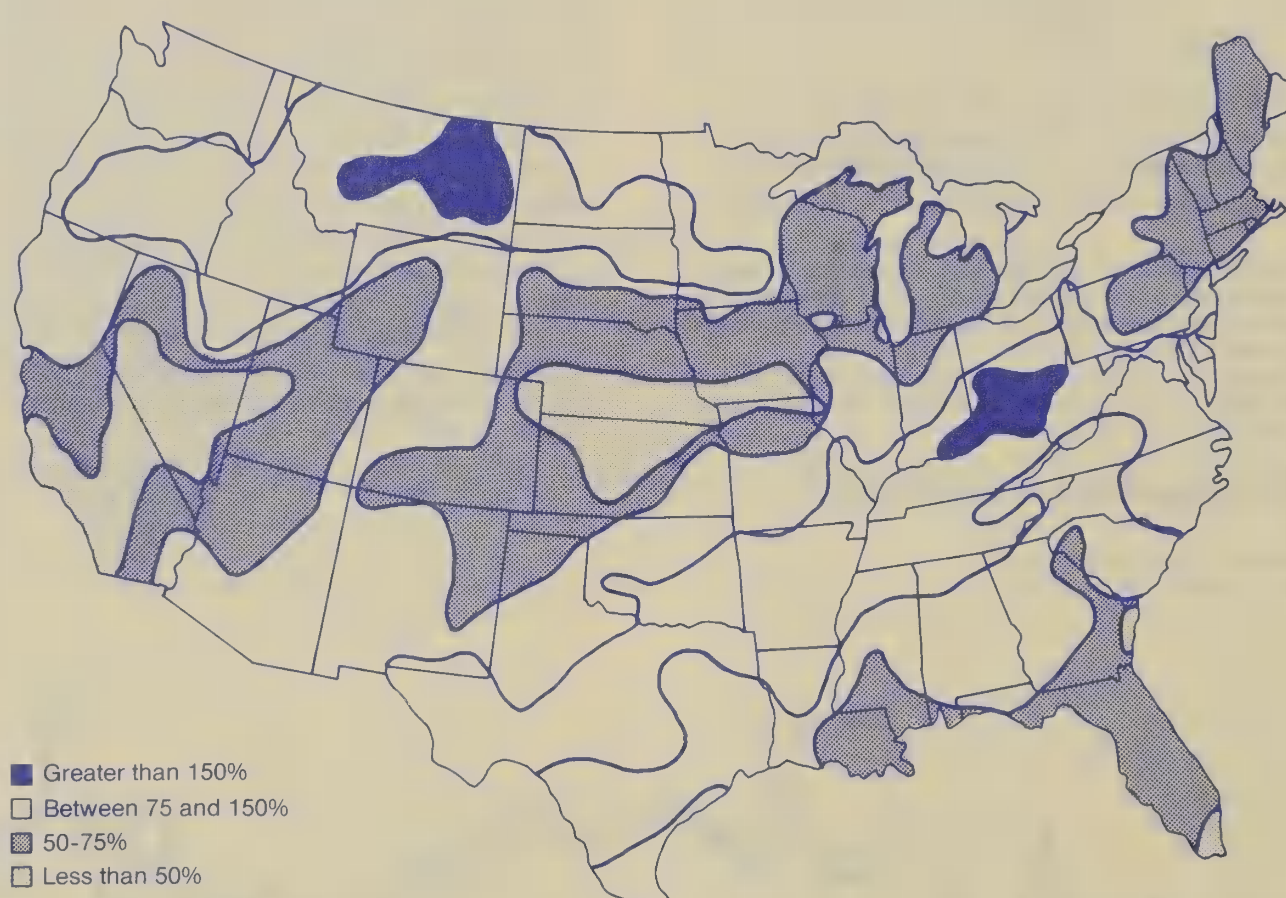
Low Soil Moisture Persists

Precipitation in the first third of 1989 (January 1-April 29) gives a good indication of beginning season topsoil moisture (fig. 6). Several large areas were below normal at the end of April, particularly the Southwest (from the Pacific Coast northeastward into the Central Rockies); areas of the Central Plains (Kansas and Nebraska) into the Corn Belt (Iowa and Missouri); and the extreme Southeast (Florida and Georgia).

Topsoil moisture at the beginning of the spring planting season was near normal in most of the Southern Plains, eastern Corn Belt, Delta States, and Appalachian regions. Preplant

Figure 6

Percent of Normal Precipitation, January 1-April 29, 1989



Source: NOAA/USDA Joint Agricultural Weather Facility.

rainfall in the Northern Plains and part of the Southeast had returned to near normal from deficits of 1988 (fig. 7).

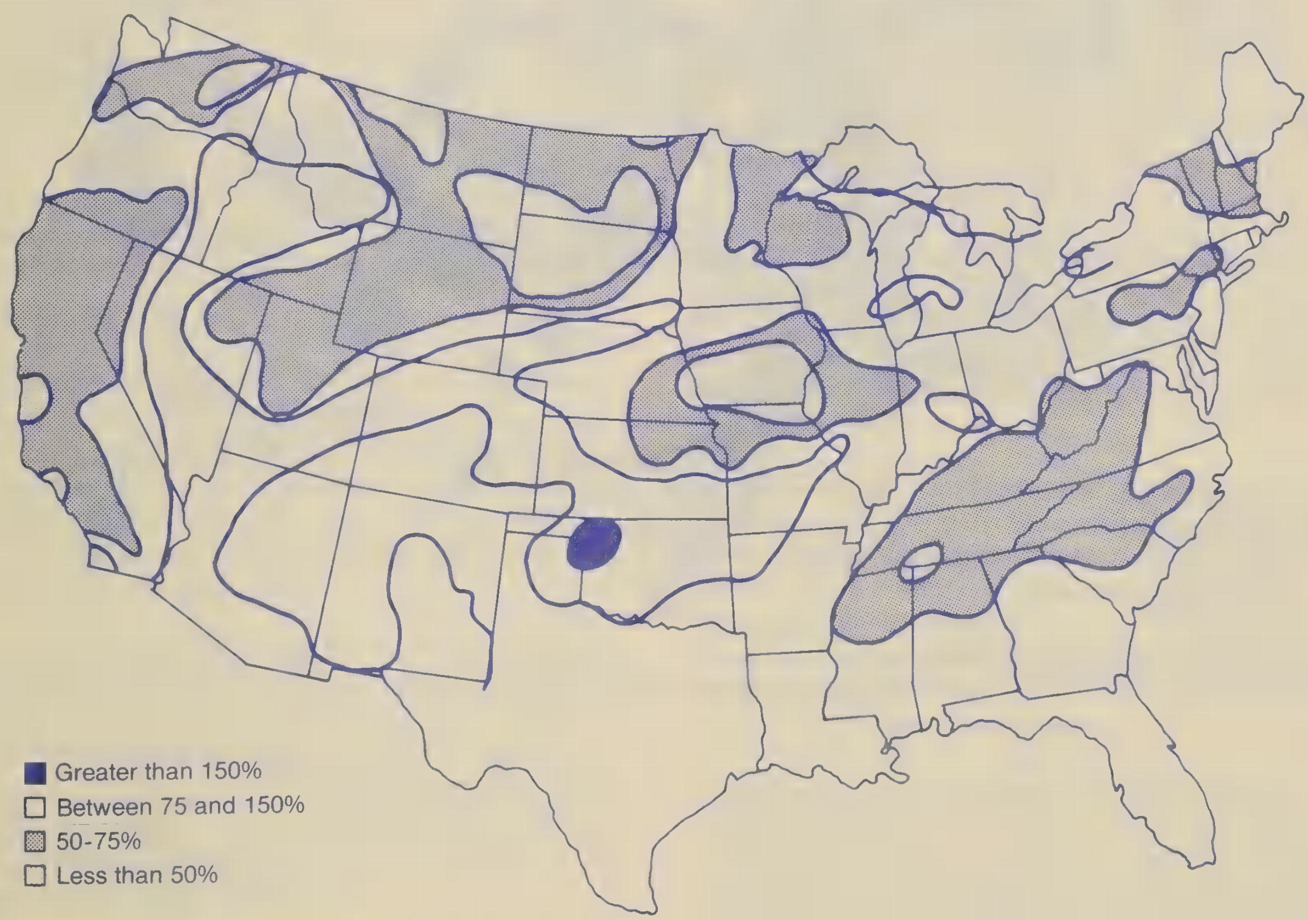
Depleted top- and subsoil moisture in the western Corn Belt and Central Plains persisting from the 1988 drought provided producers little assurance of a normal crop this year. Producers had to decide whether to: (1) gamble on timely precipitation; (2) increase irrigation applications; or (3) adopt water conservation management strategies, such as planting drought-tolerant crops, reducing seeding rates, selecting shorter season varieties, or idling land.

Except for a few pockets of drought, topsoil moisture was replenished by timely rainfall throughout the growing season for spring planted crops, decreasing their reliance on deep subsoil moisture. (The *Weekly Weather and Crop Bulletin*, published by the Joint NOAA/USDA Agricultural Weather Facility, provides current information on moisture conditions throughout the 1989 growing season (1)). Topsoil moisture has returned to near normal in most of the Corn Belt and Central Plains.

The long-term Palmer drought severity index (PDSI) is used to measure subsoil moisture. The PDSI depicts prolonged (months, years) abnormal dryness or wetness. It responds slowly to current precipitation, and does not generally indicate current crop or field conditions. Rather, the PDSI reflects the general long-term status of water supplies in terms of runoff, aquifer recharge from deep percolation, and evapotranspiration. It also indicates areas of increased production risk, where producers have adequate topsoil moisture for planting, but insufficient subsoil moisture to render production independent of the amount and timeliness of summer rains.

Figure 7

Percent of Normal Precipitation, January 1-April 29, 1989



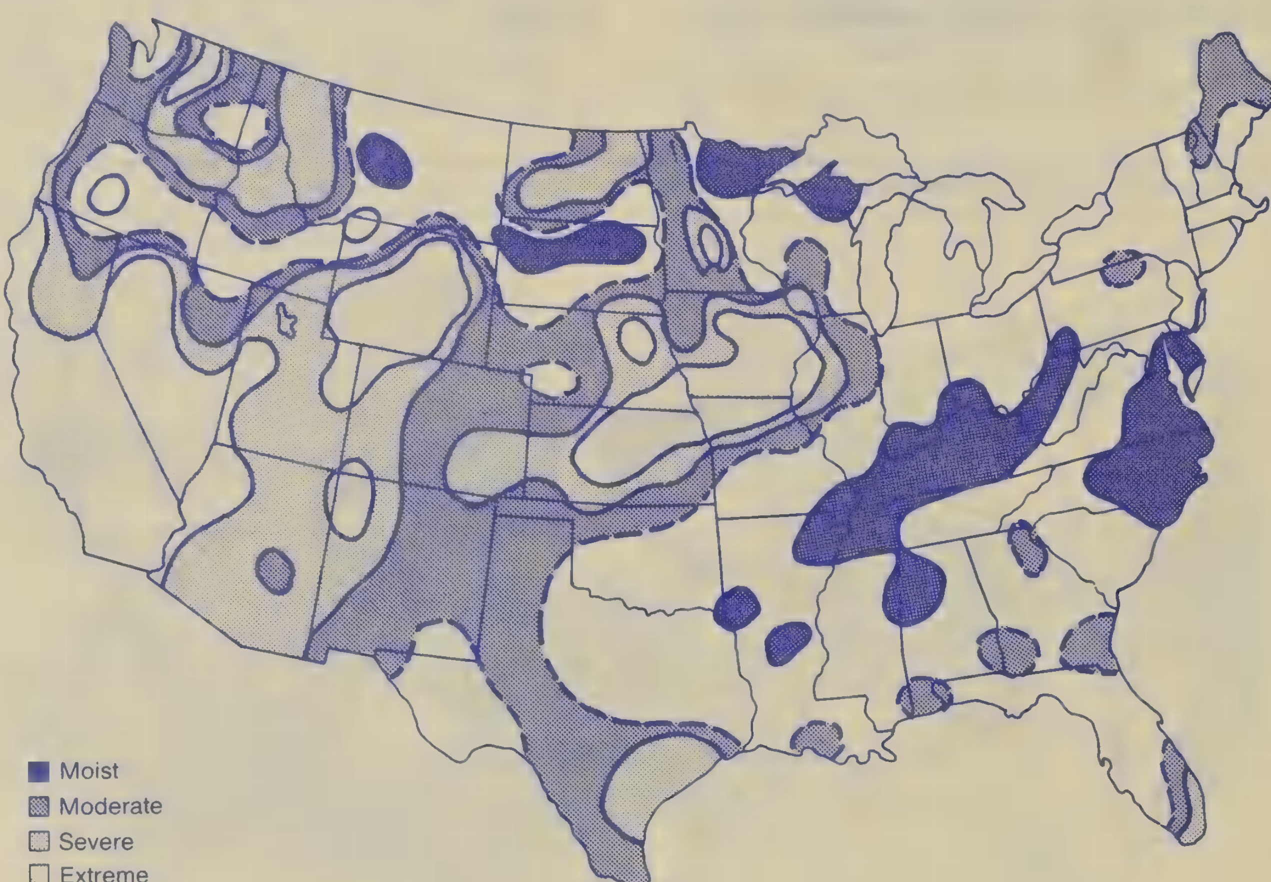
Source: NOAA/USDA Joint Agricultural Weather Facility.

Prolonged extreme, severe, or moderate drought conditions existed in early May from the California coast eastward through Illinois (fig. 8). The primary areas of extreme drought were the Southwest, Central Plains, and western Corn Belt regions. The Texas Gulf Coast, southern Florida, central North Dakota, and parts of the Pacific Northwest also experienced severe dryness; the latter two areas were still suffering from last year's drought (fig. 9). Moisture conditions in the Southeast, Northeast, and Mid-Atlantic, on the other hand, have improved.

California and areas of the Central Rockies have now suffered extreme drought conditions for 2 years in a row. However, because most of the cropland is irrigated, production continues to be nearly normal. About 90 percent of the harvested cropland in California is irrigated, and 65 percent in the Central Rockies. Except for those areas where irrigation water supplies limit output, usual crop production and normal related economic activity should be maintained.

Figure 8

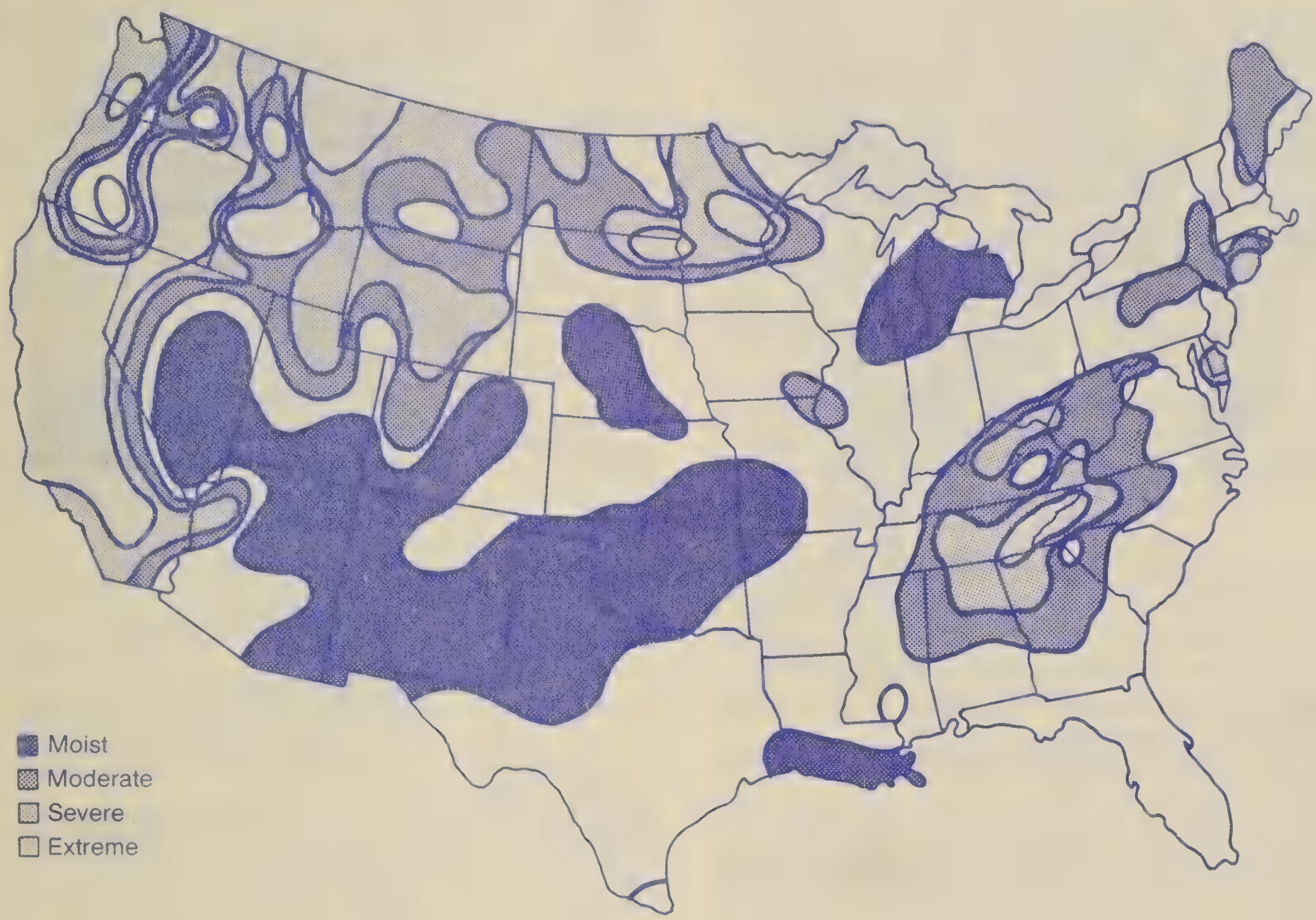
Palmer Drought Severity Index, May 6, 1989



Source: NOAA/USDA Joint Agricultural Weather Facility.

Figure 9

Palmer Drought Severity Index, April 30, 1988



Source: NOAA/USDA Joint Agricultural Weather Facility.

Surface Water Supplies Limited in Some Areas

Streamflow and reservoir supplies provide water for about 40 percent of the irrigated acreage in the United States, each source serving about 10 million acres. These surface water supplies are generally replenished each year by snowmelt and rainfall, and tend to be the cheapest source of irrigation water. In the West, reservoir levels and streamflows are carefully monitored and highly regulated.

The National Weather Service and the Soil Conservation Service (SCS) jointly forecast streamflow for the western United States based on observed winter snowpack, the estimated snowpack melt rate, and an assumption of normal summer rainfall. This spring was characterized by an early melt of a near-average snowpack over dry soil, and little snowpack was left to augment late spring and summer flows during the peak irrigation season.

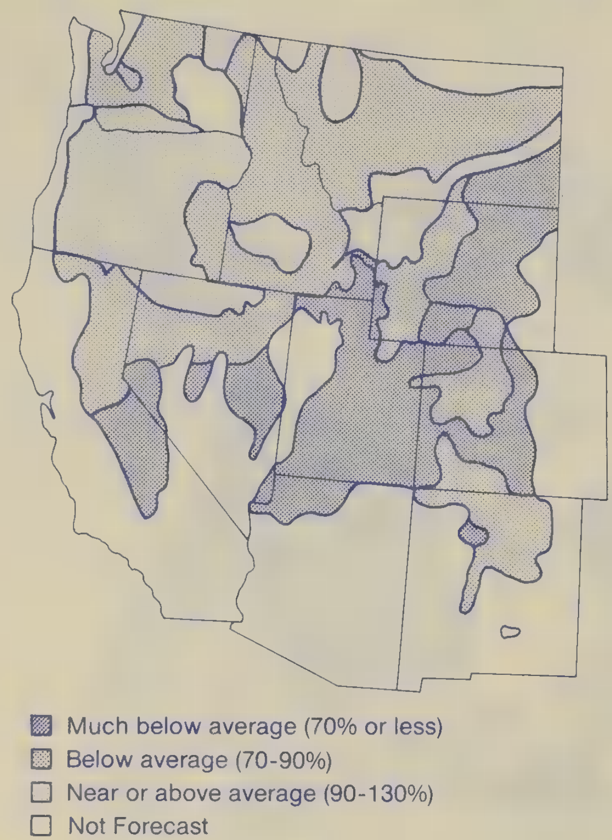
Therefore, the summer streamflow forecast for much of the irrigation-dependent West ranged from below average (70-90 percent of normal) to much below average (less than 70 percent of normal) (fig. 10). Only a few areas (primarily Oregon, the northwest Wyoming headwaters of the Snake and Yellowstone Rivers, and the mainstem of the Yellowstone River in Montana) were projected to have normal or above-normal flows.

Reservoirs supply water for about 20 percent of the total irrigated acreage in the United States. Because of the early snowmelt, water flowed into reservoirs early this year, filling many to near-normal levels by the start of the irrigation season. Reservoir conditions as of May 1, 1989 for 11 Western States show critically low levels in Nevada (53 percent of normal) and below average (less than 90 percent of normal) levels in California and Montana (fig. 11).

Reservoir levels were expected to continue to decline through the growing season, since most of the precipitation in these States occurs as snow, and most of the melt took place in early spring. Shortages of surface water for irrigation are expected in Nevada, and are likely in California and Montana. These shortages will likely result in substitution of more expensive ground water (where available) or decreased yields in cash and forage crops.

Figure 10

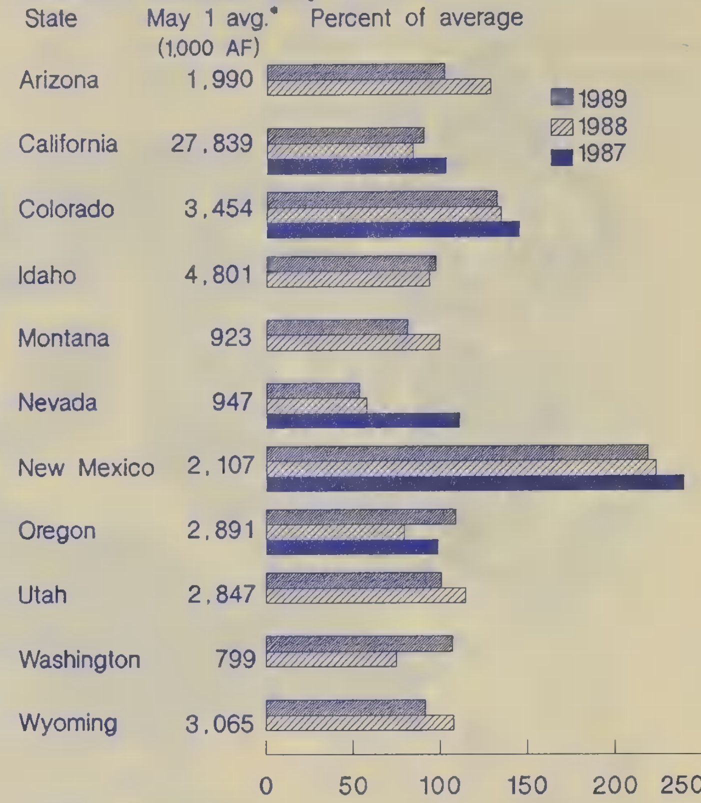
Spring and Summer Streamflow Forecast, May 1, 1989



Source: NOAA/USDA Water Supply Outlook.

Figure 11

Surface Water Storage Conditions for Western States, May 1, 1989



* Historic.

Source: USDA/SCS Central Forecast System and California Department of Water Resources.

Historic May 1 data show Idaho and Montana reservoir levels to be below normal, and Colorado and New Mexico above normal. Downward trends in reservoir levels show water storage in Nevada declining to one-half of normal and Arizona declining to normal. (But those in Colorado and New Mexico are staying well above normal.) Continuation of these trends could mean a more critical situation in Nevada and greater water imports for Arizona.

Ground Water Supplies

Ground water supplies the other 60 percent of U.S. irrigated acreage, and is the source for most domestic and livestock uses. Ground water supplies for irrigation generally come from deep aquifers that cannot be exhausted by one or even several dry years. Reduced rainfall and/or soil moisture increases ground water pumping for irrigation and aquifer withdrawals, heightening irrigation costs and exacerbating aquifer declines.

Areas of chronic ground water decline have been reported in western Kansas and Nebraska, the High Plains of Texas and New Mexico, southern Arizona, and California (3). In recent years many farmers in these areas have reduced their pumping by adopting more efficient irrigation technology and shifting to dryland farming. For some areas the water tables have stabilized and even increased.

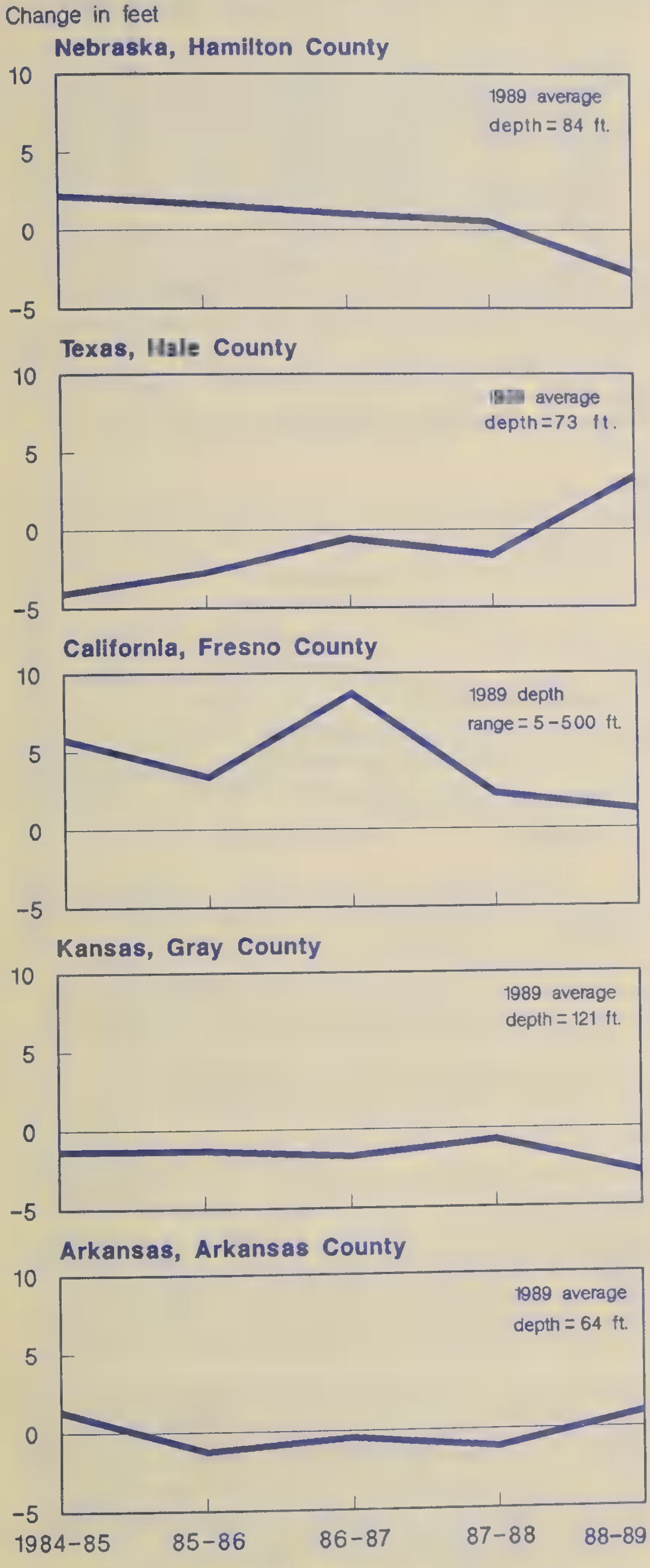
Fig. 12 shows the current water level and change in level for selected counties that depend on ground water for irrigation. The selected counties are those having the largest ground water irrigated acreage in the five States relying most on ground water for irrigation. Gray County, Kansas shows an accelerating rate of ground water decline and a worsening ground water situation. Ground water depletion has been widespread in recent years in western Kansas.

Ground water levels have fallen in 3 of the past 5 years in Arkansas County, Arkansas, a humid area with a significant amount of ground water irrigated acreage. Hale County, Texas, and much of the Texas Panhandle, which have experienced consistent declines in the water table (although they have slowed in recent years), reported rises this year.

Hamilton County, Nebraska, which exemplifies the irrigated area in the central part of the State, shows rising ground water levels through 1988, then a drop in average depth this spring. Ground water levels in Fresno County, California have been boosted by surface water imports.

Shallow aquifers, which may exhaust their usable water after several dry years, provide water for livestock, farm household, and municipal uses for some communities in more humid regions. Farmers and several towns in southern Iowa

Figure 12
Groundwater Levels and Change in Levels in Selected Counties



Sources: State U.S. Geological Survey offices in Nebraska, Kansas, and Arkansas; Texas Water Development Board; and California Department of Water Resources.

had dry wells this spring, and must therefore haul in water until deep percolation from rainfall or ground water movement recharges their aquifers.

Irrigated Acreage Increases in 1989

Preliminary estimates indicate that more farmland may be irrigated in 1989 than in any year since 1981. At 50.4 million acres, the 1989 area is up 1.7 million acres above 1988 and 4 million above that reported by the *1987 Census of Agriculture* (table 11). A greater water supply in the Northwest, a reduction in the annual crop set-aside requirements, and higher crop prices account for the increase.

Irrigated acreage inched up in most regions. Most of the increase occurred in the Northern Plains and Mountain regions, where an elaborate system of large reservoirs and downstream delivery systems supply water.

In the Delta States, however, higher cotton set-aside requirements have reduced irrigated acres. In the Southern Plains, the number of irrigated acres has been lowered over the past decade by increased cotton set-aside requirements, CRP participation, and higher pumping costs.

Irrigated Acreage Mirrors Changes in Idled Land

Since 1978, irrigated land in farms has been an almost perfect reflection of short-term cropland diversions (fig. 13). Changes in irrigated acreage correspond proportionately with changes in annual diversions.

As idled acreage expanded to 78 million from 1981 to 1983, irrigation dropped by 8.5 million acres (10.9 percent of idled acres). In 1984, irrigation increased by 6.2 million acres (12.2 percent of the 51-million-acre drop in idled acres). The 3.5-million-acre irrigation decline from 1984 to 1987 is also 10.5 percent of the 33.5-million-acre gain in annual set-

Figure 13
Irrigation Mirrors Idled Acreage

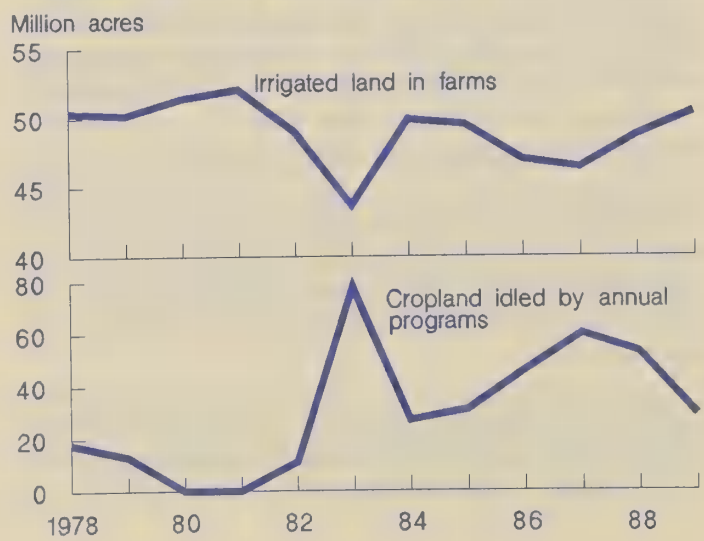


Table 11--Irrigated acreage, 1969-89, by region

Region	1969 1/	1979 2/	1981 2/	1982 1/	1983 2/	1984 2/	1985 2/	1986 2/	1987 1/	1988 3/	1989 3/
	Million acres										
Northeast, Appalachian, and Southeast	1.[illegible]	2.9	2.9	2.7	2.8	3.0	3.1	3.0	3.0	3.1	3.3
Lake States and Corn Belt	0.5	1.5	1.6	1.7	1.5	1.9	2.1	2.0	2.0	2.3	2.4
Northern Plains	4.6	9.0	9.6	9.3	7.4	9.5	9.8	9.5	8.7	9.0	9.7
Delta States	1.9	2.4	3.3	3.1	2.9	3.4	3.6	3.4	3.7	4.2	4.1
Southern Plains	7.4	7.3	7.3	6.1	5.0	6.2	5.6	5.1	4.7	5.1	5.0
Mountain	12.8	14.7	14.6	14.1	13.3	14.1	13.6	13.6	13.3	13.8	14.4
Pacific	10.0	12.2	12.5	11.9	10.7	11.7	11.5	10.8	10.8	11.0	11.4
United States 4/	39.1	50.2	52.1	49.0	43.7	49.9	49.5	47.5	46.4	48.7	50.4

1/ Census of Agriculture. 2/ Estimates constructed from several unpublished USDA sources and the Census of Agriculture. 3/ Preliminary estimates. 4/ Includes Alaska and Hawaii.

aside. The preliminary estimate of area irrigated in 1989 reflects a rise from 1987 equal to 12.8 percent of the decrease in cropland idled under annual programs.

The proportion of irrigated land in the long-term CRP, however, has not been as large as that in the annual programs. Irrigated land enrolled in the CRP through 1987 represented less than 2 percent of the total enrollment (2).

Long-term retirement of irrigated land is most likely to occur when an aquifer nears economic exhaustion (high pumping lifts eliminate profits), when old irrigation systems need costly repairs or replacement, or when farmers sell either their water or land for nonagricultural uses.

Regional Trends Differ

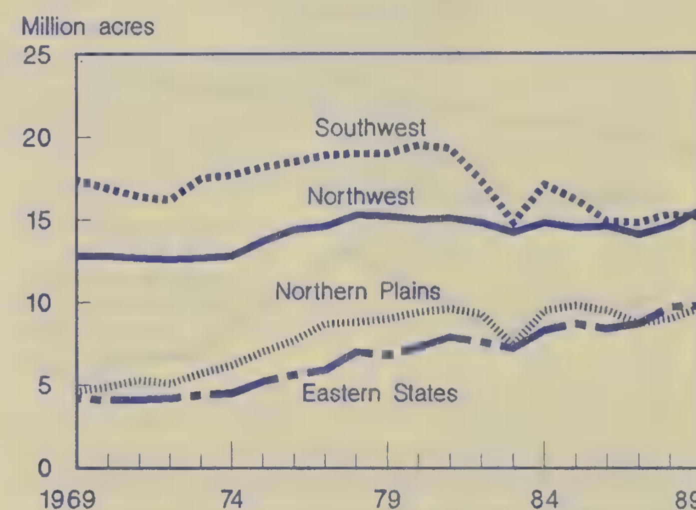
There are four regional trends in the United States that characterize change in irrigated acreage (fig. 14). The Southwest (California, Nevada, New Mexico, Arizona, Texas, and Oklahoma) adopted irrigation early. Irrigated acreage peaked in 1977-81, and has not really recovered following the lows of 1983 and 1987. This area has acute need for increasingly limited water resources, and consequently has little additional water for agriculture.

The second trend, prevalent in the Northwest (the remaining Pacific and Mountain States) consists of expansion of irrigated acres during the 1970's, a period of no growth in the early 1980's, and substantial increases in the last 2 years. The irrigated land in these areas is relatively unaffected by Federal programs, since it produces few program crops.

The Northern Plains region more than doubled in irrigated area between 1969 and 1981. This region, like the Northwest, shows a slightly positive trend in the 1980's with annual fluctuations reflecting the irrigated acres idled in Federal programs.

The fourth trend is that occurring in the more humid Eastern States, where irrigation supplements rainfall during dry periods. Irrigation in these States jumped from 4 million acres

Figure 14
Regional Trends in Irrigation



in 1969-72 to 10 million acres in 1989. In the past decade, expansion in the East has offset declines in the Southwest.

Outlook for Water Supply and Irrigation

Much of the West, Central Plains, and western Corn Belt experienced poor soil moisture conditions at the start of this year's growing season, a circumstance that increased use of irrigation water in drought areas and probably will reduce crop yields and profits. Producers without irrigation had to lower their yield and profit goals and substitute more drought-tolerant crops.

Late summer rains in the Corn Belt benefited some crops, so yields are expected to be nearly normal for most spring planted crops. Surface soil moisture across the wheat-growing area appears adequate for fall planting: however, subsoil moisture remains low, resembling the planting conditions that led to this year's short wheat crop.

Below-average streamflow projections suggested that surface water irrigators without access to stored water probably

would be unable to meet the crop needs for irrigation water this summer. Most irrigators using stored surface water did meet crop water requirements this season, since reservoir levels were adequate in most States.

If next year is also dry, surface water supplies could become critical in California, Montana, and particularly Nevada. Increased ground water pumping, especially in the Central Plains, may accelerate the aquifer decline rate (see Gray County, Kansas on fig. 12) and boost irrigation costs.

Increased moisture stress and larger irrigation applications will increase production costs and decrease profitability in the drought areas this year. Producers who anticipated lower yields tended to reduce input purchases and planned on marketing less output. This course of action reduces economic activity in the agricultural sector, and has already prompted drought-relief efforts.

In the short term, fluctuations in irrigated acreage will continue to be driven primarily by water supply conditions and annual cropland diversion programs. With little change expected in total annual diversions, irrigated area in 1990 will be close to 51 million acres.

Any longer-term policy reforms eliminating the idled land from annual programs could boost irrigation by an additional 3-4 million. (See special article entitled "From the 1985 Farm Bill to 1990 and Beyond: The Resource Effects of Agricultural Policy Reform.")

Irrigation in the Southwest shows signs of continuing decline, with only a slight increase from the 1983 and 1987 lows. In the Northwest, growth in the past 2 years has more than offset the gradual decline of the early 1980's.

Farmers in Eastern States and the Northern Plains will continue to expand irrigated area. However, lower crop prices will likely hold expansion below the 1 million acres per year of the 1970's.

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1. Joint Agricultural Weather Facility, *Weekly Weather and Crop Bulletin*, U.S. Dept. of Commerce, National Weather Service, and U.S. Dept. of Agr., National Agricultural Statistics Service, and World Agricultural Outlook Board.

2. Schaible, Glenn D., *Irrigated Acreage in the Conservation Reserve Program*, Agricultural Economic Report No. 610, U.S. Dept. of Agr., Econ. Res. Ser., July 1989.

3. U.S. Dept. of Agriculture, Economic Research Service, *Agricultural Resources: Cropland, Water, and Conservation Situation and Outlook Report*, AR-8, September 1987.

Conservation and Water Quality

Although protecting soil and water resources has long been a public policy goal, increased public awareness of actual and potential degradation in some areas has elevated its priority (box 1). Only limited information for assessing the scope of potential damage and identifying those agricultural factors affecting environmental quality is as yet available.

New research and demonstration initiatives are being designed to determine the possible environmental and economic implications of: (1) continuing to pursue current agricultural practices, and (2) using alternative production systems and technology. This section of the report addresses those actions being taken to reduce soil erosion and potential contamination of surface and ground water from agricultural nutrients and pesticides.

USDA Programs Shift Emphasis to Water Quality

The 1985 Food Security Act (FSA) created four new USDA programs and initiatives to promote soil conservation and water quality (box 2). Also, through USDA's National Conservation Program, older programs giving financial and technical assistance to farmers for implementing conservation are shifting emphasis to water quality problems. Water quality is now considered high priority research across USDA, and is being allocated additional resources in those agencies conducting or administering water quality programs.

CRP Enrollment Continues Placing Land Under Protective Cover

A total of 30.6 million cropland acres from nearly 300,000 contracts were enrolled in the Conservation Reserve Program (CRP) following the February 1989 signup (fig. 15, table 12). The enrollment target for the CRP is 40-45 million acres by the end of next year.

Nine signup periods have been held since the program began in 1986; the most recent occurred during July 17-August 4, 1989. In this latest signup, USDA received offers to place 4.2 million additional acres into the CRP. Actual contracted acreage will be less than this based on past signups with final data available in December.

The primary goal of the CRP is to reduce soil erosion on highly erodible cropland. Secondary objectives include: protecting the nation's long-run capability to produce food and fiber; reducing sedimentation; improving water quality; preserving wildlife habitat; curbing production of surplus commodities; and supporting farm income.

Erosion Reductions Diminish. Average reductions in soil erosion on new CRP lands are declining with each successive signup (table 12). The average erosion reduction for the

Box 1: Soil Conservation and Water Quality Considerations

Agricultural Erosion and Chemical Use ...

- Current agricultural land use and production systems still cause considerable soil erosion, and depend heavily on chemical fertilizers and pesticides. Erosion is much higher on some lands than others. Highly erodible cropland, just over one-tenth of total agricultural land, contributes over two-fifths of total agricultural erosion (9, 17). Average use of nitrogen and pesticides per cropland acre used for crops has been increasing, with average use in 1987-88 up one-tenth or more from 10 years earlier (6, 7).

Raise These Concerns ...

- *Soil Productivity Concerns.* Technological advances may increase future crop yields, but erosion on about 44 percent of cropland could reduce this land's yield potential and increase fertilizer cost. On the most vulnerable cropland, future yields could actually decline (3).

- *Water Quality Concerns.* Nationally, about one-third of the soil eroded by water from agricultural land enters streams and other water bodies, causing \$2-\$9 billion damage annually offsite to water-related activities such as recreation, water treatment, water storage, irrigation, navigation, and from flooding (14, 15). In some agricultural areas, enough fertilizer or pesticides may infiltrate ground water or be carried by water runoff and sediment into streams and lakes to impair water use. Surface waters threatened or impaired by agricultural sources of nonpoint pollution may include one-fifth or more of river miles and area in lakes or estuaries (4). No national assessments of ground water damage are available yet, but about one-fifth of the U.S. population draws drinking water from potentially vulnerable ground water (11). The cost of monitoring wells to detect contamination could range from \$900 million to \$2.2 billion per year (11).

- *Dust Damage Concerns.* At least \$4 billion of off-site damage occurs annually from wind erosion and dust, mostly in the Plains and Western regions. At least half of this comes from wind erosion on private agricultural lands (13).

But Control Has Tradeoffs and Costs

- Erosion and chemical runoff can be reduced by changing agricultural land use and production systems. Reduced runoff may increase infiltration to ground water, unless managed carefully. Crop yields and production may be affected, and in turn could affect the prices farmers receive and consumers pay. Costs, returns, and risks faced by farmers may change, affecting their production decisions and adoption or continuation of sound environmental practices. Large-scale programs may impact agri-industries and local economies. Conservation program costs may exceed economic benefits in some cases, or diminish funds available for other Government programs.

eighth signup fell to 14 tons per acre per year, down from 25-27 tons per acre per year in the first three signups.

CRP erosion reductions have declined because: (1) the most highly erodible land was enrolled in earlier signups; and (2) changes in program rules have expanded eligibility to include lands not presently experiencing excessive erosion, and lands having nonexistent or minimal erosion potential but whose cultivation poses water quality problems. Land enrolled as filter strips, for example, reduces sediment runoff into lakes and streams.

Average Rental Payments Trending Upward. Average annual rental payments received by farmers continue to rise with each signup (table 12). The average rental payment for the eighth signup exceeded \$51 per acre, compared with \$42 per acre for the first signup.

The rise in average rental payments can be explained by previously authorized increases in some maximum acceptable rental rates (MARR's), and by continuing shifts in regional enrollment to areas where agricultural land is relatively more productive. These areas typically have higher rental rates to compensate farmers for idling their land. An early example of this occurred in the fourth signup when the average annual rental payment received by farmers increased to \$51.19 per acre, partially due to a special corn bonus payment that attracted greater enrollment of highly valued corn base acreage.

The rise in average rental payments received by farmers in the seventh and eighth signups did not result from MARR increases. In fact, MARR's have not been increased, except due to realignment of bid pools, since the sixth signup of February 1988.

Box 2: USDA Conservation and Water Quality Programs

Food Security Act (FSA) Provisions

- **Conservation Reserve Program** (CRP) provides annual rental payments to landowners and operators who voluntarily retire highly erodible and other environmentally critical lands from production for 10 years. It also provides technical assistance and cost-sharing payments up to 50 percent of the cost of establishing a soil-conserving cover on retired land. Rental payments to any person may not exceed $50,000 per year. County enrollment is limited to no more than 25 percent of cropland, unless USDA grants a special waiver.

- **Conservation Compliance** requires that farmers who produce agricultural commodities on highly erodible cropland have approved conservation plans by Jan. 1, 1990, and finish implementing them by Jan. 1, 1995, or lose eligibility for USDA program benefits.

- **Sodbuster** provision requires that farmers who convert highly erodible land to agricultural commodity production do so under an approved conservation system, or forfeit eligibility for USDA program benefits.

- **Swampbuster** provision bars farmers who convert wetlands to agricultural commodity production from eligibility for USDA program benefits, unless USDA determines that conversion would have only a minimal effect on wetland hydrology and biology.

Continuing Assistance Programs

- **Agricultural Conservation Program** (ACP) provides financial assistance to farmers for implementing approved soil and water conservation and pollution abatement practices. Cost-sharing payments to a given farmer may not exceed $3,500 per year on 1-year agreements, and may not average over $3,500 per year on multiyear agreements. Program initiated in 1936.

- **Conservation Technical Assistance** (CTA) provides technical assistance by the Soil Conservation Service (SCS) through Conservation Districts to farmers for planning and implementing soil and water conservation and water quality improvement practices. Program initiated in 1936.

- **Great Plains Conservation Program** (GPCP) provides technical and financial assistance in Great Plains States to farmers and ranchers who implement total conservation treatment of their entire operation. Cost-sharing assistance is limited to $35,000 per farmer contract. Program initiated in 1957.

- **Small Watershed Program** provides Federal technical and financial help to local organizations for flood prevention, watershed protection, and water management. Program initiated in 1954.

- **Resource Conservation and Development Program** assists multicounty areas in enhancing conservation, water quality, wildlife habitat and recreation, and rural development. Program initiated in 1962.

- **Emergency Conservation Program** provides financial assistance to farmers in rehabilitating cropland damaged by natural disasters. Program initiated in 1978.

- **Rural Clean Water Program** is an experimental program implemented in 21 selected projects. It provides cost-sharing and technical assistance to farmers voluntarily implementing best management practices to improve water quality. Cost-sharing limited to $50,000 per farm. Program initiated in 1980; ends in 1995.

- **Extension Service** provides information and recommendations on soil and water quality practices to land owners and operators, in cooperation with SCS and Conservation Districts.

- **Farmers Home Administration** provides loans to farmers and associations of farmers for soil and water conservation, pollution abatement, and building or improving water systems that serve several farms. It may acquire 50-year conservation easements to help farmers reduce loan payments.

- **Forestry Incentives Program** provides cost-sharing up to 65 percent for tree planting and timber stand improvement for private forest lands of 1,000 acres or less.

- **Water Bank Program** provides annual payments for preserving wetlands in important migratory waterfowl nesting, breeding, or feeding areas. Program initiated in 1970.

Research Programs

- **Agricultural Research Service** conducts research on new and alternative crops and agricultural technology to reduce agriculture's adverse impacts on soil and water.

- **Cooperative State Research Service** coordinates conservation and water quality research conducted by State Agricultural Experiment Stations and land grant universities. This agency allocates and administers funds appropriated for special and competitive grants for water quality research.

- **Economic Research Service** estimates economic impacts of existing and alternative policies, programs, and technology for preserving and improving soil and water quality. With National Agricultural Statistics Service, collects data on farm chemical use, agricultural practices, and costs and returns.

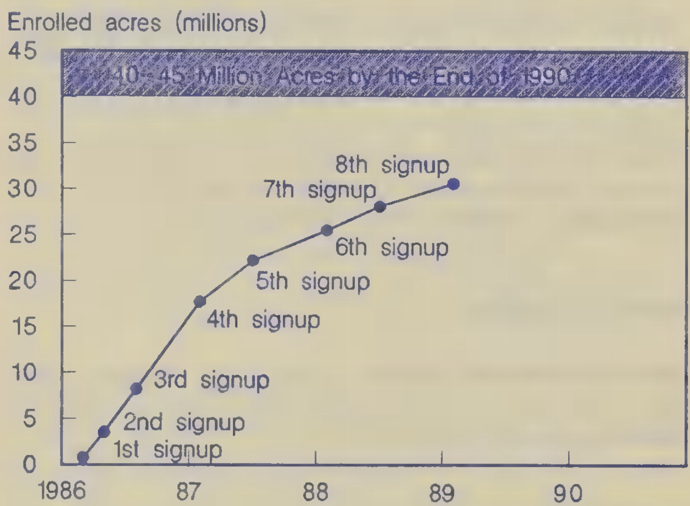
- **Forest Service** conducts research on environmental and economic impacts of alternative forest management policies, programs, and practices.

Table 12--Conservation Reserve Program Signups

Item	Number of contracts	Number of acres	Average rental rate	Average erosion reduction
	1,000	Million	$/acre/yr.	tons/acre/yr.
Signup period:				
#1-March 1986 1/	9.4	0.75	42.06	26
#2-May 1986 1/	21.5	2.77	44.05	27
#3-August 1986 2/	34.0	4.70	46.96	25
#4-February 1987 3/	88.0	9.48	51.19	19
#5-July 1987 3/	43.7	4.44	48.03	17
#6-February 1988 4/	42.7	3.38	47.90	18
#7-July/August 1988 4/	30.4	2.60	49.71	17
#8-February 1989 5/	28.8	2.46	51.04	14
Total	298.6	30.59	48.70	20
Cumulative enrollment by crop year:				
1986	21.0	2.04	43.11	28
1987	145.9	15.71	49.15	23
1988	233.5	24.47	48.52	21
1989 /6	291.0	29.60	48.78	20
1990 /6	298.6	30.59	48.70	20

1/ Eligible acres included cropland in land capability classes II through V eroding at least three times greater than the tolerance rate or any cropland in land capability classes VI through VIII. 2/ Eligible acres expanded to include cropland in land capability classes II through V eroding at least two times the tolerance rate and having gully erosion. 3/ Eligible acres expanded to include cropland eroding above the tolerance rate with an erodibility index of [illegible] or greater. 4/ Eligible acres expanded to include cropland in land capability classes II through V eroding at least two times the tolerance rate if planted in trees. Eligibility also extended to cropland areas 66 to 99 feet wide adjacent to permanant water bodies for placement in filter strips. 5/ Eligible acres expanded to include cropped wetlands and cropland areas subject to scour erosion. 6/ Actual number of contracts, acres enrolled, rental rates and erosion reduction are not final pending future signups.

Figure 15
CRP Enrollment Moves Toward Goal



Enrollment Concentrated in the Plains and West. CRP enrollment remains primarily concentrated in the Northern Plains, Southern Plains, and Mountain States (fig. 16). In each of these regions, enrollment accounts for over 50 percent of CRP-eligible land (fig. 17, table 13). Together these regions make up 62 percent of total enrollment, although they comprise only 45 percent of county-constrained eligible land nationwide. Conversely, the Corn Belt, which contains approximately 24 percent of the nation's CRP-eligible land, accounts for only 14 percent of enrollment.

In recent signups, the percentage of enrollment in the Southern Plains and Mountain regions has decreased, while enrollment in the Corn Belt has increased slightly relative to other regions. Enrollment in the Northern Plains, however, remains strong. Due in part to the enrollment of newly eligible cropped wetlands, this region's enrollment accounted for 41 percent of the eighth signup total.

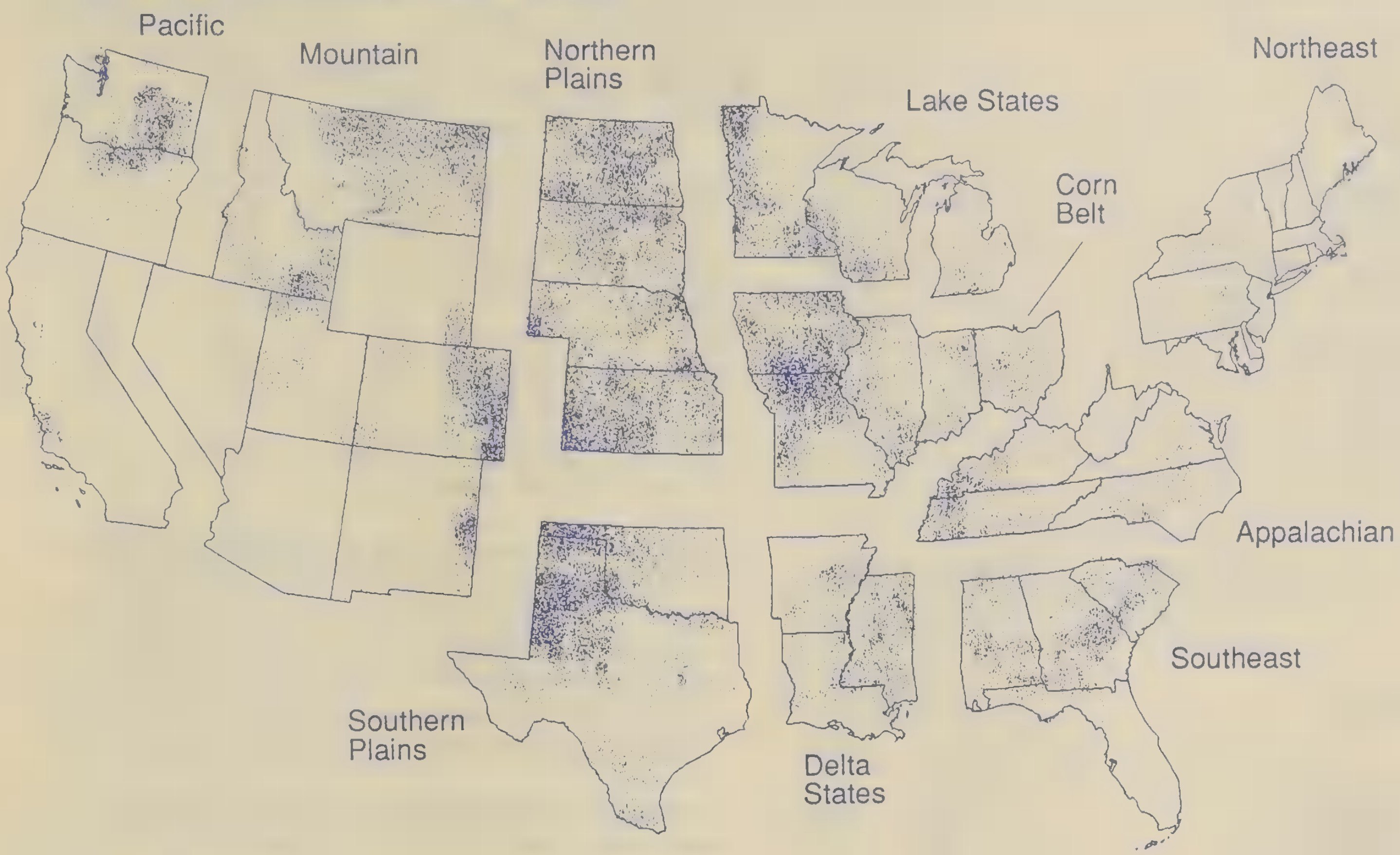
Grass Favored as Cover, But Trees Growing in Importance. By far the majority (89 percent) of the land enrolled in the CRP has or will receive grass and legume covers (table 14). Tree planting, the next most popular conservation practice, accounts for only a little more than 6 percent of all enrolled acreage. CRP legislation calls for 12.5 percent of enrolled acres to be devoted to trees if practicable. In recent signups, tree planting has grown in popularity to cover approximately 8 percent of new acreage enrolled.

Wildlife habitat, diversions, various control structures, and filter strips were placed on a smaller number of enrolled acres than trees. Filter strips, which were only approved as a CRP conservation practice as of the sixth signup, have been or will be installed on approximately 40,000 acres.

Enrollment of Cropped Wetlands and Scour Erosion Areas Allowed. Beginning with the eighth signup, CRP eligibility was expanded to include wetlands farmed for at least 2 years between 1981 and 1985 and fields that demonstrate substantial scour erosion. In scour erosion, overflowing water from streams and rivers washes away soil. Land enrolled into the CRP under these eligibility provisions must be planted to trees unless the Soil Conservation Service (SCS) determines that tree-planting is inappropriate. In the eighth signup, 156,000 wetland acres and approximately 64,000 scour erosion acres were enrolled.

Figure 16

CRP Enrollment through February 1989

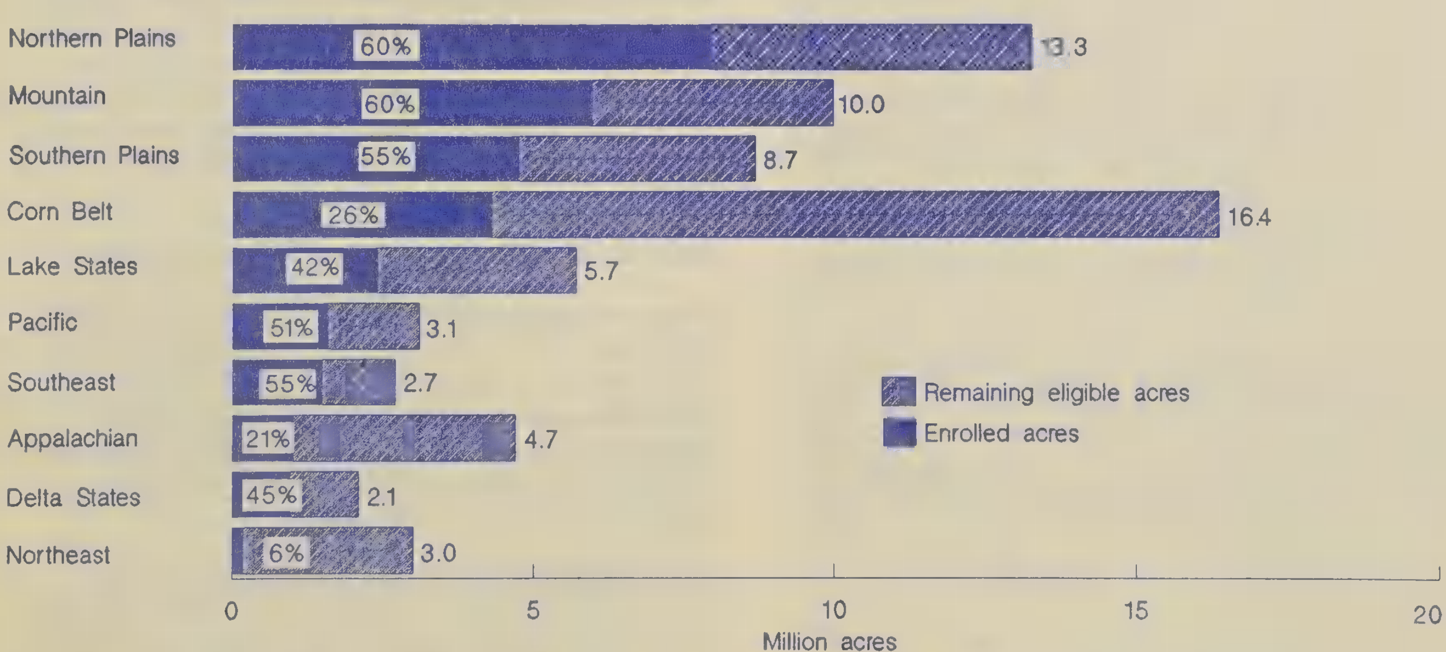


1 dot = 1,000 acres.

30.6 million acres enrolled through eighth signup, in February 1989.

Figure 17

CRP Enrollment Greatest in Plains and Mountain Regions



Percentages show regional enrollment as a percent of regional eligibility. Other numbers show total regional eligibility.

Table 13--Regional distribution of current CRP eligibility

Region	CRP through February 1989			CRP eligibility		
	Enrolled acres	Share of U.S. enrolled acres	Percent of region cropland	County-constrained eligible acres 1/	Share of U.S. total	Percent of region cropland
	Million	- - - Percent - - -		Million	- - - Percent - - -	
Northeast	0.18	0.6	1.1	3.0	4.3	17.4
Lake States	2.40	7.8	5.5	5.7	8.2	13.0
Corn Belt	4.30	14.1	4.7	16.4	23.5	17.7
Northern Plains	7.96	26.0	8.6	13.3	19.2	14.2
Appalachian	1.00	3.3	4.4	4.7	6.7	20.6
Southeast	1.48	4.8	8.1	2.7	3.9	14.8
Delta States	0.95	3.1	4.3	2.1	3.0	9.6
Southern Plains	4.75	15.5	10.5	8.7	12.5	19.4
Mountain	5.97	19.5	13.8	10.0	14.3	23.1
Pacific	1.58	5.2	7.0	3.1	4.5	13.7
United States	30.59	100.0	7.3	69.7	100.0	16.6

1/ Enrollment constrained to no more than 25 percent of the cropland in each county.

Table 14--CRP acreage treated by various conservation practices, through February 1989

Practice	Total enrollment	
	Acres	Share of acres enrolled
	Thousand	Percent
Grass cover	27,094	88.2
Tree planting	1,959	6.4
Wildlife habitat	1,481	4.8
Diversions	83	0.3
Filter strips 1/	40	0.1
Erosion, sediment, & water control structures	40	0.1
Grass and sod waterways	15	0.0
Shallow water Areas	7	0.0
Field windbreaks	6	0.0
Total 2/	30,593	100.0

1/ Filter strips were approved as a CRP conservation practice beginning with the 6th signup held during February 1988. 2/ Acres where more than one practice was applied are counted only once in the total.

Special Provisions Again Made for Haying and/or Grazing CRP Land in 1989. To ameliorate the effects of continuing drought, the Government permitted farmers in approximately 253 counties experiencing livestock emergencies to harvest or graze grass on CRP land as of June 26, 1989. Normally, haying, grazing, or other commercial use of forage on CRP acreage is prohibited. But last year, because of the severe drought, farmers in nearly 2200 counties were authorized to carry out emergency haying.

Farmers using this special provision in 1989 must comply with a number of restrictions designed to safeguard wildlife habitat and control erosion. For example, only land placed in grass on or before December 1, 1987 may be used for haying or grazing. In return, farmers must forego 50 percent of their 1989 CRP rental payments for the land that is grazed or harvested for hay, a stricter requirement than in 1988.

Proposed Legislation Would Expand CRP and Allow Limited Commercial Use. Bills introduced in the 101st Congress, if enacted, would enlarge the CRP from a maximum of 45 million acres by 1990 to a maximum of 60 million acres by 1995, provided the Secretary of Agriculture finds that sufficient land would remain in production to meet domestic and foreign commodity requirements. CRP eligibility would be expanded to include highly erodible pasture land and areas where agriculture contaminates ground water.

Another proposal would allow hay harvesting, timber harvesting, or grazing on CRP land during the last 3 years of the contract and would authorize unspecified compensation payments to farmers. In return, farmers would grant the Secretary of Agriculture a permanent conservation easement on the land, or permanently retire the cropland's base and allotment history.

Other proposals include: raising the proportion of CRP acres planted with trees to 50 percent for new enrollment; lengthening the CRP contract to 15 years for land planted in hardwood trees; adding 5 years of base acreage protection at the conclusion of the CRP contract if the farmer continues to devote acreage to a conserving use; and requiring farmers to maintain soil erosion at or below the soil loss tolerance level if they return the land to crop production at the end of the contract.

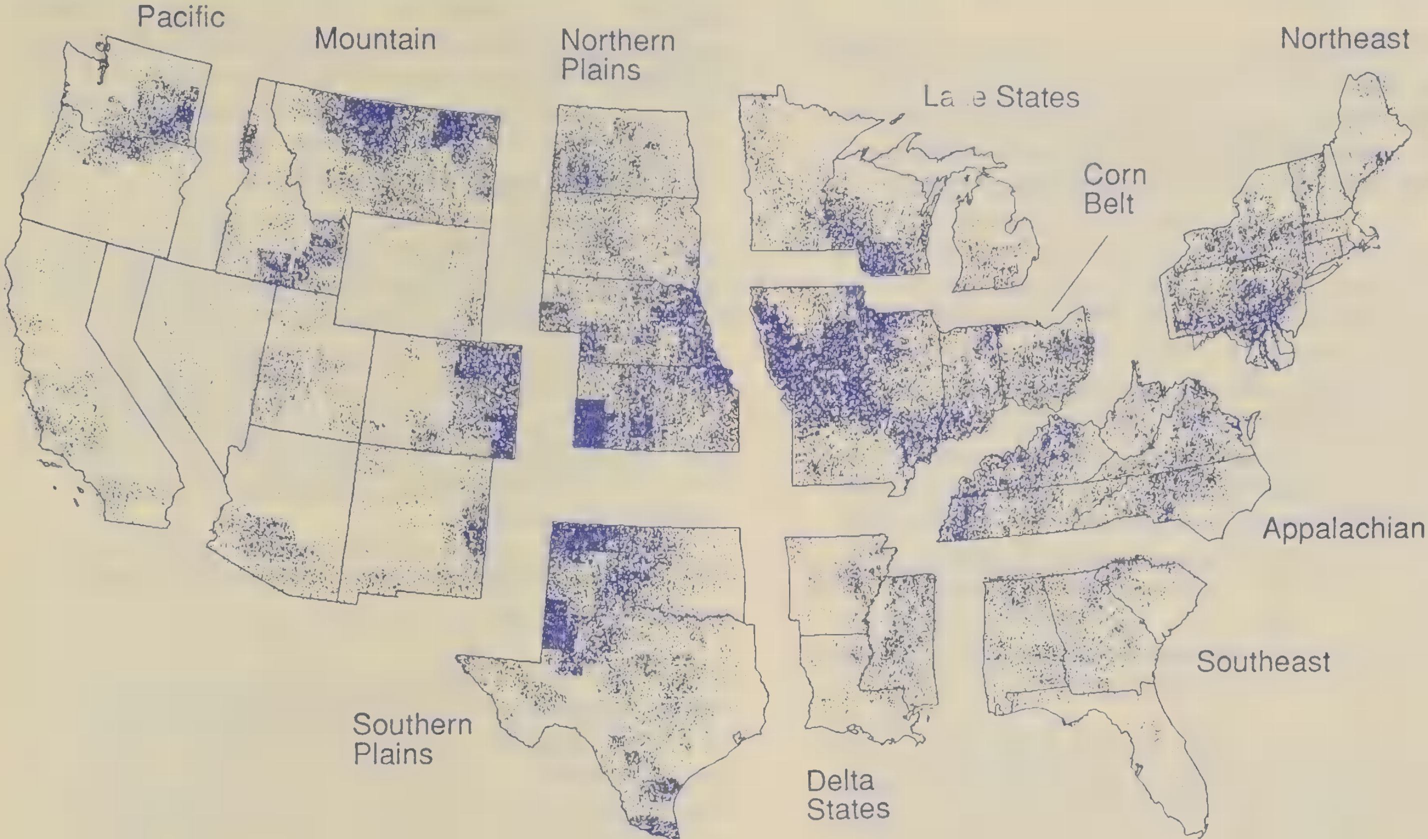
Conservation Compliance Takes Effect January 1

The planning phase of Conservation Compliance is nearing completion (box 2). USDA has completed determinations on the highly erodible status of nearly all of the 139 million acres in fields initially identified as subject to Conservation Compliance. This land is mainly concentrated in the Corn Belt, Plains, and Mountain regions, but substantial acreages also exist in other regions (fig. 18).

As of July 1989, conservation plans had been approved for approximately 119 million acres, 89 percent of the estimated acreage requiring compliance plans. Such plans have been

Figure 18

Highly Erodible Land Potentially Subject to Conservation Compliance



1 dot = 1,000 acres.

applied to 33 million acres, including highly erodible land enrolled in the CRP.

For Conservation Compliance plans to be approved, they must be based on SCS field office technical guides. These guides contain alternative conservation systems that have been judged to be economically and technically feasible, and thus acceptable, for local areas. Strict adherence to the soil loss tolerance (T) rate is not an explicit criterion for conservation plan approval.

Sodbuster and Swampbuster Determinations Underway

From the time enforcement began in January 1986-April 1989, 584 agricultural producers have been determined to be in violation of the Sodbuster provision, and another 427 in violation of the Swampbuster provision. Sodbusting occurs when a producer converts highly erodible land not used to produce an agricultural commodity in at least 1 year from 1981 through 1985 to the production of an agricultural commodity without an approved conservation plan. Swampbusting entails converting wetlands to commodity production.

Most Sodbuster and Swampbuster determinations have been appealed by the affected producers. Of 386 appeals for Sodbusting determinations through April 1989, 330 have been approved by USDA, 31 were not approved, and 25 were still pending. Of 393 appeals for Swampbusting, 243 were approved, 71 were not approved, and 79 were still pending.

Appeals to Sodbusting were approved by USDA when producers provided sufficient evidence of cropping history or adequate conservation practices on the land. Appeals to Swampbusting were approved when evidence was shown of having commenced the drainage before the December 1985 deadline. Producers who did not appeal, or had their appeals not approved, lose all USDA program benefits for the year(s) in which they remain in violation.

Assistance, Education, and Research Programs Stress Water Quality

Part of the Agricultural Conservation Program (ACP) consists of Water Quality Special Projects. In 1989, 42 projects were funded, up from 24 in 1988. Allocations in 1989 for cost-sharing and technical assistance for the 42 projects will total \$9-\$13 million (5-7 percent of the ACP budget). Except for these special projects, States and counties set the priorities for evaluating farmers' requests for financial assistance, in view of local soil and water quality problems. Farmers who must implement conservation practices to meet Conservation Compliance plans or avoid Sodbuster penalties may apply for ACP financial assistance. The Agricultural Stabilization and Conservation Service (ASCS) which

administers the ACP, expects such requests to rise as compliance takes effect.

SCS has accorded water quality top priority along with soil conservation. SCS has updated its field office technical guides, and held regional training sessions to provide State and local conservation personnel the tools to protect and improve water quality through conservation systems.

The Cooperative Extension System has accelerated programs to help farmers, landowners, and rural residents grasp the scope and dimension of the water quality problem and the potential impacts that their day-to-day decisions regarding land use, chemical use, and waste disposal have on water quality. New educational materials are being developed that describe the interactions of soils, pesticides, nitrates, and water quality. Programs to test rural water supplies to identify problems have been initiated or intensified. Fertilizer recommendations are being reviewed and, in some cases, reduced. The need for soil testing is stressed as the basis for determining fertilizer needs. Also, a training module on ground water has been incorporated into many certification and training programs for pesticide applicators.

Some USDA agencies have been expanding their resources to research ways of reducing agricultural sources of surface and ground water pollution. The Administration's Budget Proposal for 1990 includes an initiative for increased efforts to protect ground and surface water from potential contamination by agricultural chemicals and wastes, especially pesticides and nutrients. The initiative focuses on developing and promoting the use of safe and effective pest control, fertilization, and production systems that are economically and environmentally sustainable. It also attempts to enhance data collection and analysis and improve reference materials to aid decisionmaking.

EPA Programs Affect Agriculture

The Environmental Protection Agency (EPA) administers water quality related activities and programs which affect agriculture (box 3). Section 319 of the 1987 Water Quality Act requires States and territories to prepare: (1) water quality assessment reports that identify nonpoint source water pollution problems; and (2) management programs that deal with these problems. Forty-three States and territories have submitted nonpoint source pollution assessments to EPA, and 36 have submitted final management programs.

Also, under the Water Quality Act's National Estuary Program, planning is underway to control nonpoint source pollution in 12 major estuaries. Several of these estuaries receive substantial amounts of nonpoint pollution from agricultural sources.

EPA now lists 83 contaminants, including pesticides, to be regulated under the 1986 Safe Drinking Water Act (SDWA) amendments. The regulations apply to public water supply systems and nontransient, noncommunity water systems such as schools and factories. Maximum contaminant levels (above which the standards must be enforced) have been proposed for 17 pesticides, including alachlor, aldicarb, atrazine, ethylene dibromide (EDB) and dibromochloropropane (DBCP). EPA will issue regulations for another 28 contaminants, including 9 pesticides, next year.

EPA's National Survey of Pesticides in Drinking Water Wells is underway to determine the presence and concentration of 127 frequently used agricultural chemicals in 1,350 statistically selected wells. EPA expects to issue a draft report on the survey in late 1991. As part of the public information program, EPA has developed brief, nontechnical health advisory summaries for 60 chemicals. These summaries can be obtained by calling EPA's safe drinking water hotline, 1-800-426-4791.

State Conservation and Water Quality Programs Affect Agriculture

Thirty-six States provide financial or regulatory incentives for installing and maintaining best management practices (BMP's) to promote soil conservation and protect surface water quality (8, 10). Financial incentives include: cost-sharing programs (in 26 states); income or property tax credits or deductions (in 7 States), no- or low-interest loans (in 5 States); and purchasing conservation easements or development rights in agricultural lands (in 3 States).

On the regulatory side, 17 States require either approved plans or permits for activities that could cause soil erosion or pollution discharges into waterways, or compliance with established permissible soil loss limits. Ten of these States give farmers cost-sharing assistance specifically to help them meet the requirements.

So far only about one-third of the States have developed programs to protect or improve ground water quality. EPA gives the States primary responsibility for ground water protection and for developing the necessary strategies, and the States have begun to respond. Examples include: Iowa's Ground Water Protection Fund and Ground Water Protection Strategy (supported in part by a nitrogen fertilizer tax); Massachusetts' Wellhead Protection Program (which established land use control and restricts pesticide use in critical recharge areas around wells); and Wisconsin's Risk Assessment Program (which is based on numerical ground water standards).

Conservation Expenditures Up Again in 1988-89

USDA and related State and local conservation expenditures could exceed \$3.2 billion in 1989, up \$700 million from 1988 and \$1.2 billion from 1987 (fig. 19). The \$1.8 billion

Box 3: EPA Programs Affecting Agriculture

1987 Water Quality Act Nonpoint Programs

- Section 319 of the Act requires States and territories to file assessment reports with EPA identifying navigable waters where water quality standards cannot be attained or maintained without reducing nonpoint source pollution. States must also file management programs with EPA identifying steps which will be taken to reduce nonpoint pollution in those waters identified in the State assessment reports. The Act authorizes up to $400 million total in Federal funding for implementing the programs.

1987 Water Quality Act National Estuary Program

- Section 320 of the Act provides for identification of nationally significant estuaries threatened by pollution, preparation of conservation and management plans, and Federal grants to prepare the plans. Estuaries with planning underway include: Puget Sound, San Francisco Bay, Santa Monica Bay, Galveston Bay, Sarasota Bay, Albermarle/Pamlico Sounds, Delaware Bay, Delaware-Inland Bays, Long Island Sound, New York/Jersey Harbor, Narragansett Bay, and Buzzards Bay.

1987 Water Quality Act Clean Lakes Program

- Section 314 of the Act requires States to submit assessment reports on the status and trends of lake water quality, including the nature and extent of pollution loading from point and nonpoint sources. Also, methods to control pollution and to protect/restore the quality of lakes impaired or threatened by pollution must be described.

- Financial assistance is given to States to prepare assessment reports and to implement watershed improvements, as well as to conduct in-lake restoration activities. Several USDA small watershed projects (PL-566) have been coordinated with Clean Lakes projects.

FIFRA Pesticide Programs

- The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) gives EPA responsibility for registering new pesticides and for reviewing and re-registering existing pesticides to ensure that, when used according to label directions, they will not present unreasonable risks to human health or the environment.

Regional Water Quality Programs

- The EPA and other Federal agencies are cooperating on several regional programs to reduce nonpoint source pollution, including the Chesapeake Bay Program, the Colorado River Salinity Control Program, the Great Lakes Program, the Gulf of Mexico Program, and the Land and Water 201 Program in the Tennessee Valley Region.

Safe Drinking Water Act Programs

- The Safe Drinking Water Act (SDWA) requires EPA to publish maximum contaminant levels (MCL's) for any contaminants which may have adverse health effects in public water systems (those serving over 25 persons or with 15 connections). Standards established by EPA under the SDWA are also being used as guidelines to assess contamination of ground water in private wells. The EPA also sets nonregulatory health advisory levels on contaminants for which MCL's have not been established.

- The SDWA also established a wellhead protection program to protect wells and wellfields that contribute drinking water to public supply systems. Each State must prepare and submit to EPA a Wellhead Protection Program. States have been encouraged to include agricultural sources of contamination in these programs.

Near Coastal Waters Strategy

- Through its Near Coastal Waters Strategy, EPA is integrating its water quality programs to target priority problems and prevent pollution in near coastal waters. This includes the implementation of nonpoint source management programs in coastal counties and will, in several cases, encompass accelerated implementation of agricultural conservation programs.

Table 15--USDA conservation expenditures from appropriations, fiscal 1983-90 1/

Activities and programs 2/	All conservation expenditures							
	1983 actual	1984 actual	1985 actual	1986 actual	1987 actual	1988 actual	1989 estimated	1990 budgeted
	$ million 1/							
A. Technical assistance and extension	300.4	318.3	326.7	323.3	373.9	403.5	436.0	412.1
Conservation technical assistance (SCS) 3/	276.9	293.7	302.1	286.2	328.5	366.1	386.6	393.7
Extension information and education (ES)	15.9	16.0	16.4	16.3	15.7	16.6	16.8	15.0
Cooperative forestry management (FS)	7.6	8.6	8.2	10.0	7.7	15.2	11.2	0.0
Technical/assistance--CRP (SCS/ASCS) 4/	0.0	0.0	0.0	10.8	22.0	5.6	21.4	3.4
B. Cost-sharing for practice installation	270.6	267.5	257.8	192.3	463.2	502.5	765.6	389.7
Agricultural Conservation Program (ASCS)	190.0	190.0	214.9	138.9	176.9	176.9	176.9	8.0
Forest Incentives Program (ASCS)	12.5	12.5	12.5	11.2	11.9	11.9	12.4	0.0
Water Bank Program (ASCS)	8.8	8.8	8.8	9.3	8.4	8.4	9.0	0.0
Great Plains Conservation Program (SCS)	21.3	21.3	21.6	20.5	20.5	20.5	20.5	18.6
Cover establishment--CRP (ASCS/CCC) 4/	38.0	34.9	0.0	12.4	245.5	284.8	546.8	363.1
C. Project conservation programs	324.5	207.9	219.0	292.3	210.8	201.0	197.5	120.6
Watershed and flood prevention (SCS)	246.7	150.0	192.7	265.2	185.8	175.9	172.4	96.1
Resource conservation & development (SCS)	77.8	57.9	26.3	27.1	25.0	25.1	25.1	24.5
D. Subtotal for implementation (A + B + C)	895.5	793.7	803.5	807.9	1047.9	1107.0	1399.1	922.4
E. Conservation data and research	191.5	196.3	192.0	196.2	210.1	218.6	226.6	232.8
Soil and water conservation research (ARS)	63.5	63.7	63.7	62.4	59.3	60.5	66.1	76.1
Cooperative State research (CSRS)	28.0	27.5	27.5	29.8	39.7	36.8	35.6	30.9
Forest environment research (FS)	19.6	20.4	20.3	23.9	27.7	28.3	31.2	29.7
Plant materials centers (SCS)	3.8	4.0	4.1	3.9	4.6	4.9	5.0	6.9
Resource economics research (ERS)	5.0	7.7	5.4	4.0	4.0	3.1	3.0	5.4
Data collection and analysis (SCS) 5/	71.6	73.0	71.0	72.2	74.8	85.0	85.7	83.8
F. Rental payments--CRP (ASCS/CCC) 4/	0.0	0.0	0.0	0.0	410.0	760.1	1192.0	1672.0
G. Total distributed expenditures (D + E + F)	1087.0	990.0	995.5	1004.1	1668.0	2085.7	2817.7	2827.2

1/ Current dollar estimates from Budget of the U.S. Government for Fiscal Year 1990 (Appendix) (19), and earlier years, supplemented with unofficial data from several sources (9,12). Includes water quality expenditures. 2/ Responsible USDA agencies in parentheses; CCC--Commodity Credit Corporation; SCS--Soil Conservation Service; ES--Extension Service; FS--Forest Service; ASCS--Agricultural Stabilization and Conservation Service; ARS--Agricultural Research Service; CSRS--Cooperative State Research Service; and ERS--Economic Research Service. 3/ Includes the SCS inventory and monitoring, resource appraisal, and program development activities carried out by SCS. 4/ All included as conservation, since the principal purpose of the CRP is conservation. 5/ Includes river basin surveys and investigations, soil surveys, and snow survey water forecasting.

Table 16--Farm operator expenditures on conservation and land improvements, 1981-88

Year	Expenditures 1/
	$Million
1981	1,170
1982	625
1983	779
1984	613
1985	442
1986	410
1987 /2	308
1988 /2	323

1/ Includes land clearing, land leveling, soil and water conservation, drainage systems, and other land improvements. 2/ Does not include expenditures for flood control, clearing and leveling, or roads and lanes which were included in previous years.

spent on the CRP, up almost $1.1 billion from 1987, accounts for most of the increase. However, the net cost of the CRP is less than this amount—it has supply control benefits and reduces USDA's expenditures on commodity price support programs.

An increase in State and local government appropriations to fund local programs appears likely. In some States, the increase may be used to supplement the CRP rental payment and help defray the cost of establishing the vegetative cover (18).

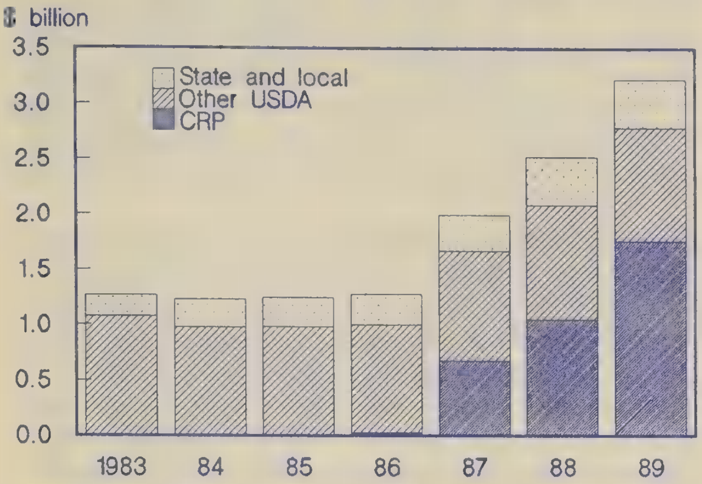
USDA conservation expenditures may reach $2.8 billion in 1989, up $700 million (about one-third) from 1988 and $1.1 billion (two-thirds) from 1987 (table 15). The $2.8 billion for conservation proposed in the fiscal 1990 budget slightly exceeds 1989 estimated spending; however, the proposal includes recommendations to consolidate and reduce some programs, and actually terminate several on-farm cost-sharing programs.

The 1989 CRP expenditure consists primarily of $1.2 billion for rental payments on retired land and $547 million for USDA cost-sharing to establish cover. Together these two CRP items represent nearly 62 percent of total USDA conservation expenditures (fig. 20). Expenditures for technical assistance and extension services constitute about 16 percent of USDA conservation spending.

Farmer expenditures in 1988 for conservation and land improvements amounted to an estimated $323 million (table 16). After a substantial decline during the mid-1980's, expenditures were marginally higher in 1988. Farmer expenditures for conservation in 1989 are expected to outstrip those of 1988 as farmers pay their share of CRP cover establishment costs and begin to implement conservation practices to meet Conservation Compliance requirements.

Figure 19

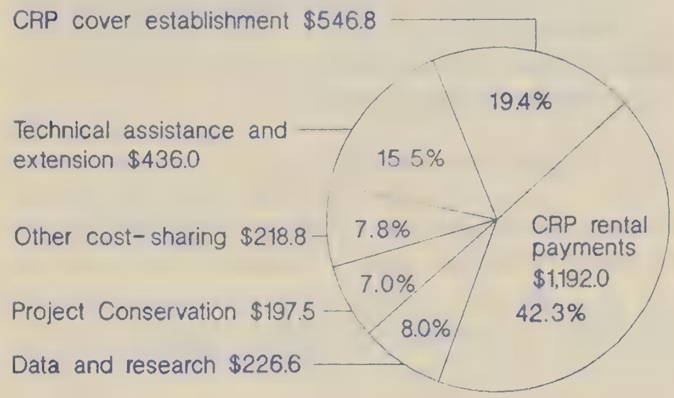
Conservation Expenditures by USDA and Related State and Local Programs



Sources: (9, 12, 18, 19)

Figure 20

USDA Conservation Expenditures, 1989



In millions. Total = $2,818.0 million.

Grass Cover the Principal USDA-Assisted Practice

In 1987, nearly 16 million acres were treated and another 3.5 million acres were served (affected) by conservation practices funded through USDA cost-sharing assistance (table 17), the largest number of acres ever to receive such practices in 1 year. Nearly 9 out of 10 treated acres received a permanent grass or legume cover, mostly as part of the CRP.

Tree planting was a distant second, comprising about 6 percent of this acreage, again mostly under the CRP.

In the 1980's before the CRP, 4-5 million acres were treated annually; and another 3-7 million were served with cost-shared conservation practices under the ACP. The acreage treated and served by ACP cost-shared practices is trending downward. While ACP expenditures have been fairly constant, the cost of installing practices has gone up.

Table 17--Acres treated or served by cost-sharing practices, 1981-88

Practice and program	1981	1982	1983	1984	1985	1986	1987	1988
				Million acres treated				
Permanent vegetative cover:								
Agricultural Conservation Program (ACP)	2.78	2.44	2.79	2.14	2.31	1.56	1.54	NA
Conservation Reserve Program (CRP)	1/	1/	1/	1/	1/	1.70	12.42	7.67
Tree planting:								
ACP	0.12	0.11	0.10	0.08	0.12	0.12	0.15	NA
CRP	1/	1/	1/	1/	1/	0.21	0.76	0.47
Cropland protective cover:								
ACP	1.50	1.11	1.10	0.79	0.80	0.64	0.60	NA
Conservation tillage:								
ACP	0.72	0.73	0.92	4.01	1.08	0.63	0.43	NA
Strip cropping systems:								
ACP	0.12	0.12	0.12	0.10	0.13	0.09	0.08	NA
Total treated 2/:								
ACP	5.24	4.52	5.04	4.13	4.44	3.04	2.80	NA
CRP	1/	1/	1/	1/	1/	2.04	13.67	8.53
Total	5.24	4.52	5.04	4.13	4.44	5.08	16.47	NA
				Million acres served				
Grazing land protection (ACP)	3.44	2.68	2.74	2.54	3.03	2.03	1.74	NA
Irrigation water cons. (ACP)	0.40	0.69	0.75	0.62	0.68	0.49	0.47	NA
Terraces and diversions (ACP)	0.58	0.55	0.62	0.50	0.54	0.41	0.64	NA
Water impoundments (ACP)	0.79	0.48	0.41	0.32	0.30	0.21	0.20	NA
Sediment & water control structures (ACP)	0.42	0.30	0.31	0.22	0.23	0.22	0.17	NA
Sod waterways (ACP)	0.73	0.49	0.45	0.21	0.23	0.18	0.13	NA
Other practices (ACP)	0.88	0.35	0.37	0.27	0.25	0.24	0.18	NA
Total	7.24	5.54	5.65	4.68	5.26	3.78	3.53	NA

NA = not available

1/ The CRP was not available. 2/ Includes some practices not listed.

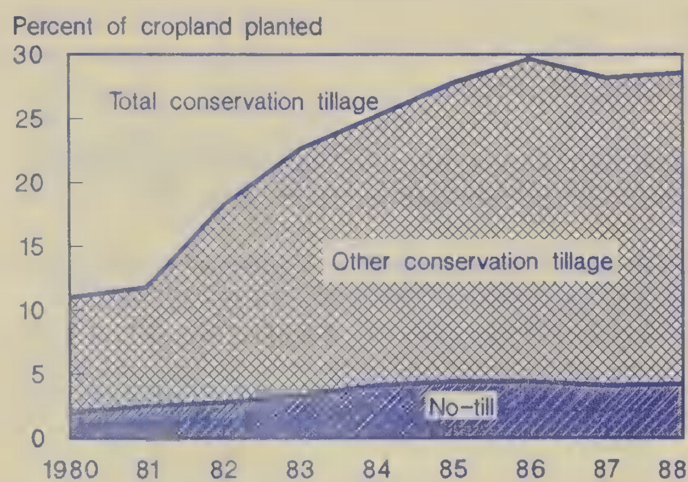
Source: (1) and CRP program data.

Farmers implementing conservation tillage have benefited from SCS and Extension Service technical assistance and education and, in some cases, from ACP and other Federal and State cost-sharing. Farmers, however, have borne most of the costs of transition themselves. During the 1980's, only 400,000 to 1 million acres of conservation tillage received ACP cost-sharing each year.

Conservation Tillage Use Stable

Relative use of conservation tillage, a technique involving fewer tillage operations than conventional tillage and covering 30 percent or more of the soil surface with protective residue after planting, appears to have leveled off since 1986 (fig. 21). The drop in cropland planted and associated expansion of cropland acres idled under Federal acreage reduction programs (in 1987 and 1988) included cropland susceptible to erosion, especially those acres enrolled in the CRP. These idled acres probably encompassed cropland that had been previously farmed using conservation tillage practices.

Figure 21
National Use of Conservation Tillage



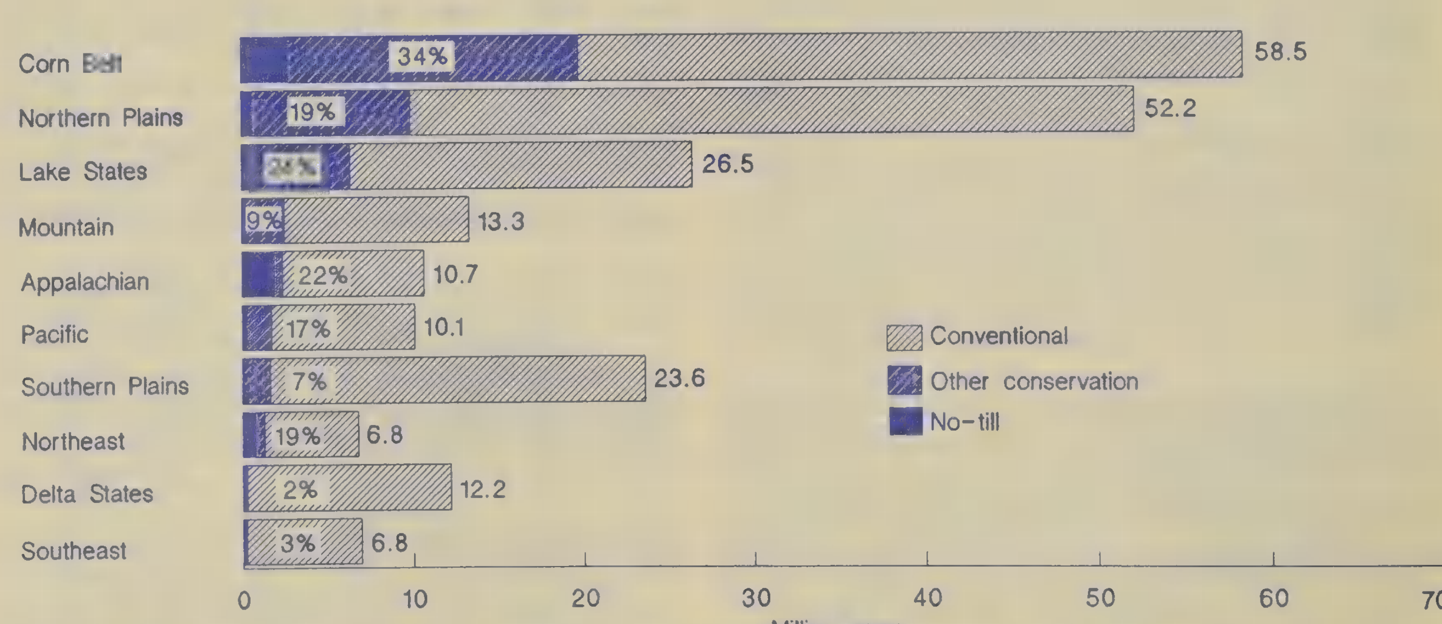
Sources: (5,16.)

National estimates of conservation tillage use in 1988 were derived from several sources. USDA's Farm Costs and Returns Survey (FCRS) of farm operators estimated that conservation tillage was used on 46.1 million acres (about 21 percent) of the acres planted to major crops in 1988. Regions with the greatest areas planted to crops—the Corn Belt, Northern Plains, and Lake States—also reported the largest acreages under conservation tillage, and accounted for over three-fourths of the nation's conservation tilled acres last year (fig. 22).

The Corn Belt had the highest relative use of conservation tillage (34 percent) on planted acres in 1988, followed by the Lake States and Appalachian regions (fig. 22). The regions with the lowest relative rates (3 percent or less) included the Delta States and Southeast.

Estimates indicate that the use of no-till, ridge till, and strip till increased in 1988, accounting for almost 19 percent of all types of conservation tillage applied that year. No-till, ridge till, and strip till generally leave more residue after planting and provide more erosion control than mulch- or reduced-till-

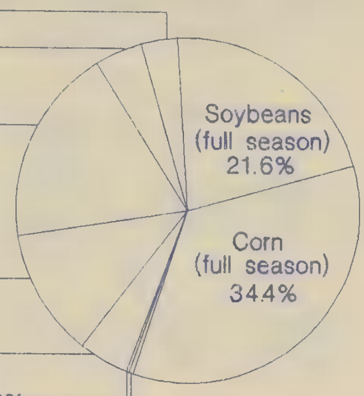
Figure 22
Tillage Practices on Acres Planted, 1988



Percentages show regional conservation tillage use as a percent of acres planted in the region. Numbers show total acres planted in the region. USDA's 1988 Farm Costs and Returns Survey.

Figure 23

Share by Major Crop of Total Acres Planted with Conservation Tillage, 1988



Source: (5.)

age operations. However, use of these practices is concentrated—over two-thirds of their total acreage is located in the Corn Belt, Appalachian, and Northeast regions.

The Conservation Technology Information Center (CTIC) gathers conservation tillage estimates from SCS district conservationists, and provides data on its use to produce major crops (fig. 23). These estimates indicate that conservation tillage in 1988 was frequently used with double-cropping (about 57 percent of the double-cropped soybeans, 52 percent of the double-cropped corn, and 47 percent of the double-cropped sorghum acreage).

Among the full-season or first crops, corn had the highest relative use at 44 percent, followed by soybeans, small grains, and sorghum at 30 percent or higher. No-till was the most frequently used conservation tillage technique on double-cropped corn and soybeans, and was used on about one-third of the acres planted to these crops.

Compliance on HEL Could Affect Tillage

Plans for conservation compliance on highly erodible land (HEL) will rely heavily on conservation tillage, residue management, and cropping practices. These practices require lower cost outlays than structural measures, so many producers having HEL may implement them to retain their eligibility for Federal program benefits. Such a trend could spur conservation tillage use, particularly during the early 1990's.

HEL already under conservation tillage may be shifted to no-till or ridge-till to further reduce erosion. Greater use of no-till and other conservation tillage in areas vulnerable to ground water contamination must be managed to prevent increased nutrient and pesticide infiltration.

Programs Achieve Record Erosion Prevention, But Drought Heightens Wind Erosion

Conservation practices and land retirement implemented in 1989 have reduced long-term average annual erosion by an estimated 328 million tons (table 18). This amount is down from the over 450 million ton reduction in 1988, because less land went into the CRP in 1989. Even so, this reduction, plus the erosion prevented on CRP lands treated in 1986-88, should boost the total to around 840 million tons, a new record for USDA programs.

This average level of erosion prevention excludes any changes in wind and water erosion caused by the 1988-89 droughts. The haying and grazing permitted on some CRP lands would have increased their susceptibility to erosion. In many cases, the dry conditions prevented establishment of cover crops on new CRP lands.

The Great Plains (mainly Kansas, North Dakota, and Texas) experienced wind erosion damage to 14.3 million acres of crop and range lands from November 1988 to May 1989, the worst damage in over 30 years (20). This total would have been greater if not for permanent cover and other conservation practices used on many lands. Damage from wind erosion results when small mounds or drifts of soil occur, or blown soil covers vegetation.

Although the annual acreage reduction programs are designed to control supply rather than reduce erosion, erosion reduction averaging 2-5 tons per acre per year does occur from idling cropland. This reduction is much smaller than the 20-ton-per-acre average so far achieved by the CRP, which is targeted largely to HEL and has strict requirements for establishing quality protective cover.

The contributions of the ACP and the Conservation Technical Assistance Program (CTA) to erosion reduction remain fairly constant. However, the size of the contributions are underreported because the available data reflect only the soil savings from newly installed conservation practices. Many practices installed in earlier years continue to reduce erosion today, but no estimates of this effect exist.

Lands enrolled in the CRP alone are estimated to reduce average erosion by over 590 million tons a year. Achievement of a 45-million-acre CRP by 1990/91 could reduce average erosion on contracted lands by 685-776 million tons annually while the program remains in full effect. Over the 14-year life of the program (1986-1999), the accumulated soil kept in place could exceed 7.5 billion tons.

Agricultural Soil Erosion Could Be Reduced By One-Fourth

In 1990 farmers will begin bringing HEL not in the CRP into compliance with SCS conservation guidelines. The compli-

Table 18--Average annual erosion prevented by USDA programs

Treatment category and program	Year					
	1985 estimate	1986 estimate	1987 estimate	1988 estimate	1989 projection	1991 projection
	Million tons					
Erosion prevented on lands newly treated under:						
Conservation Reserve Program (CRP)	NA	57	304	153	78	
Agricultural Conservation Program (ACP)	41	30	29	4/ (29)	(29)	
CTA/SCS 1/	169	167	161	163	(163)	
Annual ARP 2/	61	92	112	107	58	
Total	271	346	606	452	328	
Erosion prevented by practices on land previously treated under:						
CRP /1	NA	NA	57	361	514	685-776
ACP	NA	NA	NA	NA	NA	NA
CTA only	NA	NA	NA	NA	NA	NA
Total erosion prevented:						
All treated lands with available data 3/	271	346	663	813	842	
CRP only		57	361	514	592	685-776

NA = Not available

1/ Conservation Technical Assistance and other Soil Conservation Service apart from that under CRP and ACP. 2/ Annual acreage reduction programs. 3/ Includes CRP and the erosion prevented on land newly treated under other programs. 4/ Estimates in parenthesis are assumed to be the same as in previous year.

ance provision could reduce average erosion by another 300-500 million tons a year. When the 10-year CRP contracts begin expiring in 1995, land under the program will either: (1) continue under permanent cover; or (2) have to comply with SCS guidelines if the farmer wants to return it to crop production and also wants to qualify for USDA program benefits.

After all conservation provisions of the 1985 FSA take full effect in the mid-1990's, the average reduction in erosion could exceed 1 billion tons annually, down one-fourth from the average annual agricultural erosion of the early 1980's. These reductions may be realized, unless they are offset by such factors as changes in agricultural commodity prices or a policy that encourages expansion of acreage for row crops or other crops having higher erosion potential.

Surface and Ground Water Pollution Reduced by CRP

Reduced erosion and water runoff from CRP lands not only lowers the sediment delivered to streams and water bodies, but also sediment-attached and water-carried nutrients and pesticides. Some estimates now exist of the water quality effects of the CRP; they indicate that achievement of a 45-million-acre program could reduce sediment entering surface waters by 205 million tons (9 percent), total phosphorous by 133,000 tons (7-8 percent) and total organic nitrogen by 700,000 tons (9-10 percent) (15).

Over one-tenth of land eligible for the CRP may be susceptible to ground water contamination (2). These vulnerable lands, once placed into the CRP, will receive lower fertilizer and pesticide applications, thus reducing amounts available for runoff and infiltration.

Economic Impacts of CRP Are Mixed

Placing 45 million acres of cropland into retirement under permanent cover will generate significant environmental and national resource benefits. Surface water quality benefits from reduced sediment, nutrients, and pesticides could reach \$1.9-\$5.6 billion over the 1986-99 period. They stem from increased recreational use, lower water treatment costs, reduced sediment removal costs, and less flood and equipment damage (15, 21).

Some ground water quality benefits may also be generated by cropland retirement, since part of the land was potentially vulnerable to ground water contamination. Other benefits include improved wildlife habitat and associated recreation, less dust damage from wind erosion, and preservation of soil productivity, which means higher yields and lower fertilizer needs when the land comes back into production.

The retirement of 45 million acres could reduce production of wheat, corn, sorghum, and barley by 8-22 percent. This will increase the market prices of these grains and consequently boost farmers' income. Also, those farmers planting trees will reap timber income in the future.

On the other hand, consumers could pay higher prices for food, and agribusiness may suffer from reduced volume and income. Areas with high CRP enrollment and with economies heavily dependent on agriculture could see drops in economic activity and earnings.

Government costs of the CRP, which could range from $21-$23 billion, will be partially offset by reductions in commodity program payments. Overall, the estimated economic benefits of a 45-million-acre CRP appear to exceed its costs, giving the program a positive net effect on national income (21).

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U.S. Agriculture and Water Quality: Scope and Extent of the Problem

by

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Abstract: Agricultural chemicals and sediments from eroding cropland can degrade the quality of surface and ground waters. This article presents an overview of the scope and extent of water quality problems related to agricultural production. Many of the ground water resources supplying drinking water to the rural United States are potentially vulnerable to leached agricultural chemicals, particularly pesticides and nitrates. Many U.S. lakes, streams, and estuaries are adversely affected by fertilizers, pesticides, and sediments in cropland runoff. The economic costs of this water quality problem may exceed several billion dollars annually. New policies and programs have been proposed to address this problem at both the State and the Federal levels.

Keywords: Water quality, ground water, pesticides, nitrates, DRASTIC score.

Introduction and Overview

Water quality problems have risen to the top of the agricultural-environmental policy agenda. In particular, the potential for chemical residues to reach ground and surface water has become a priority issue for numerous public and private organizations, including USDA (11). Water quality issues will remain prominent in policy discussions in the foreseeable future. This article explores the nature, extent, and economic implications of the water quality problems related to agricultural production, and the relationships between environmental policies and the agricultural sector.

Agricultural Production Affects Ground Water

Until relatively recently, little was known about agricultural chemicals (pesticides and nutrients) and other residuals in ground water and other sources. Despite the known and suspected risks to human health from the presence of pesticides and nitrates in drinking water, the severity of any potential contamination problem was unknown. (See the accompanying box for definitions of terms.)

However, discoveries of chemical residuals in ground water during the late 1970's and early 1980's dispelled the commonly held view that ground water was protected from agricultural chemicals by impervious layers of rock, soil, and clay, and by degradation of the chemicals. In a recent status report on the occurrence of pesticides in the nation's ground water, the Environmental Protection Agency (EPA) confirmed that residues from 46 pesticides have been detected in 25 States and that these residues were attributed solely to normal agricultural use.

Although some of these detections may represent single observations at trace levels, and therefore do not pose an immediate problem, 18 pesticides have been detected at concentrations equal to or above EPA's proposed health advisory levels (13). Ground water may also be contaminated by other sources, including nonagricultural use of pesticides and fertilizers, and leaking underground storage tanks.

Ground water is a difficult resource to manage. First, information about the quality of U.S. ground water supplies is inadequate because consistent and comprehensive data are unavailable. This lack of information makes the extent of human exposure to chemical residuals and the relationship between human activities (particularly agricultural practices) and ground water contamination difficult to assess. In addition, once residuals have been identified, continued monitoring is expensive and time-consuming.

Also, chemicals applied may take years to leach through the soil profile and reach the ground water supply. Thus, chemicals discovered in ground water today may be the consequence of farming activity undertaken decades ago. Any action taken today may not affect water supplies for many years. Treating ground water, once it has been contaminated, is costly.

Ground water moves very slowly through an aquifer. Once nitrogen (which breaks down into nitrates) from fertilizer or pesticides enters the water supply, it may remain in an aquifer for many years. Treating contaminated water before use or providing alternative drinking water supplies are two ways to protect residents of areas where ground water is vulnerable to leaching pesticides or nitrates, but both are very costly.

Although the problems of detecting and monitoring ground water contamination are difficult, the potential hazards to human and animal health from exposure to agricultural chemical residues are significant. Although concern about human exposure to these chemicals in drinking water is para-

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Estimating Ground Water Vulnerability

One of the major challenges facing the development of policies to protect ground water is the identification of areas susceptible to contamination from agricultural chemicals. What is needed is a procedure by which policymakers can target areas where ground water is potentially at risk from the use of agricultural chemicals. The difficulty lies in developing a methodology which allows for the estimation of contamination risk at the regional or national level, while at the same time remains sensitive to the variability in ground water hydrology at the local level.

The first step in this process is to define the various concepts used to characterize ground water quality. The following terminology will be used throughout this paper (8):

Vulnerability—A property of an aquifer which indicates the likelihood and extent of its becoming contaminated if a contaminant is introduced at the land surface. This usually refers only to the aquifer's hydrogeologic characteristics, and does not consider the usefulness of the water nor the presence of sources of contamination.

Contamination—Presence in ground water, due to human activities, of any substance not normally found in a particular aquifer, regardless of its concentration or of the usefulness of the water.

Pollution—Contamination to an extent that the water is unsuitable for some use for which it was previously suitable.

The DRASTIC Index

There are many models in use today which attempt to predict the potential for ground water contamination. Obviously, no method is capable of capturing all the factors which influence the movement and transformation of chemicals in the environment. There are, however, tools available which focus on specific aspects of the problem. The sophistication of these various tools ranges from the complex mathematical models designed for a specific site to the more general indices which can be applied over larger areas. The DRASTIC index, developed for EPA by the National Water Well Association, is an empirical model used to estimate the ground water contamination potential for any hydrogeologic setting in the United States (2). Overall, the DRASTIC index is a very useful model for evaluating and mapping general ground water vulnerability.

DRASTIC was designed to include only those factors which influence vulnerability:

D = depth to water table;

R = net recharge;

A = aquifer media;

S = soil media;

T = topography (percent slope);

I = impact of vadose zone; and

C = hydraulic conductivity of the aquifer.

The DRASTIC score for a given site is computed by assigning a rating for each factor, then multiplying each rating by a weight that reflects the importance of each factor relative to overall vulnerability. These products are summed to yield the DRASTIC score:

$$\text{DRASTIC score} = D_rD_w+R_rR_w+A_rA_w+S_rS+T_rT_w+I_rI_w+C_rC_w$$

where:

r = factor rating; and

w = factor weight.

One of the main limitations of using a numerical index such as DRASTIC is that the scores assigned to each factor do not represent true mathematical relationships; a factor rating of 4 does not mean that the impact of that factor in terms of contamination potential is twice as great as would be the case with a rating of 2. An additional concern is that the wide range of values between the minimum and maximum possible DRASTIC scores may exaggerate the sensitivity of the index, given the general nature of the data and the methods used to assign factor ratings. In an attempt to minimize the effect of this exaggerated sensitivity, DRASTIC scores have been grouped to indicate low, moderate, and high potential for ground water contamination. These categories were determined by numerically sorting the county-level DRASTIC scores and establishing the cut-offs for the "low" and "high" categories at the bottom 10 percent and the top 30 percent, respectively (1). This leaves a large "moderate" range which minimizes the risk of a highly vulnerable county being misclassified as having a low potential for contamination, and vice versa.

mount, chemicals in ground water may also cause problems in the agricultural sector (toxicity in farm animals, for example) and may eventually degrade surface water quality at aquifer outflows. Determining the potential for exposure to chemicals in drinking water is critical to establishing a clear relationship between such exposure and potential health effects.

Areas Vulnerable to Ground Water Contamination

The potential for fertilizers and pesticides to accumulate in ground water depends on a combination of environmental and human factors. In general, areas where chemical leaching may present a risk to ground water have sandy, highly permeable soils low in organic matter, receive enough rainfall or irrigation to promote deep leaching, and are located over shallow, unconfined aquifers.

The potential for chemicals to reach the ground water is also strongly influenced by the history of fertilizer and pesticide use on the farm, the method and rate of applications, the chemical properties of the materials applied (such as solubility in water, tendency to adsorb onto soil particles, and persistence in soil), and the management practices used on the farm (crop rotations, tillage systems, and cultivation methods) (4, 5).

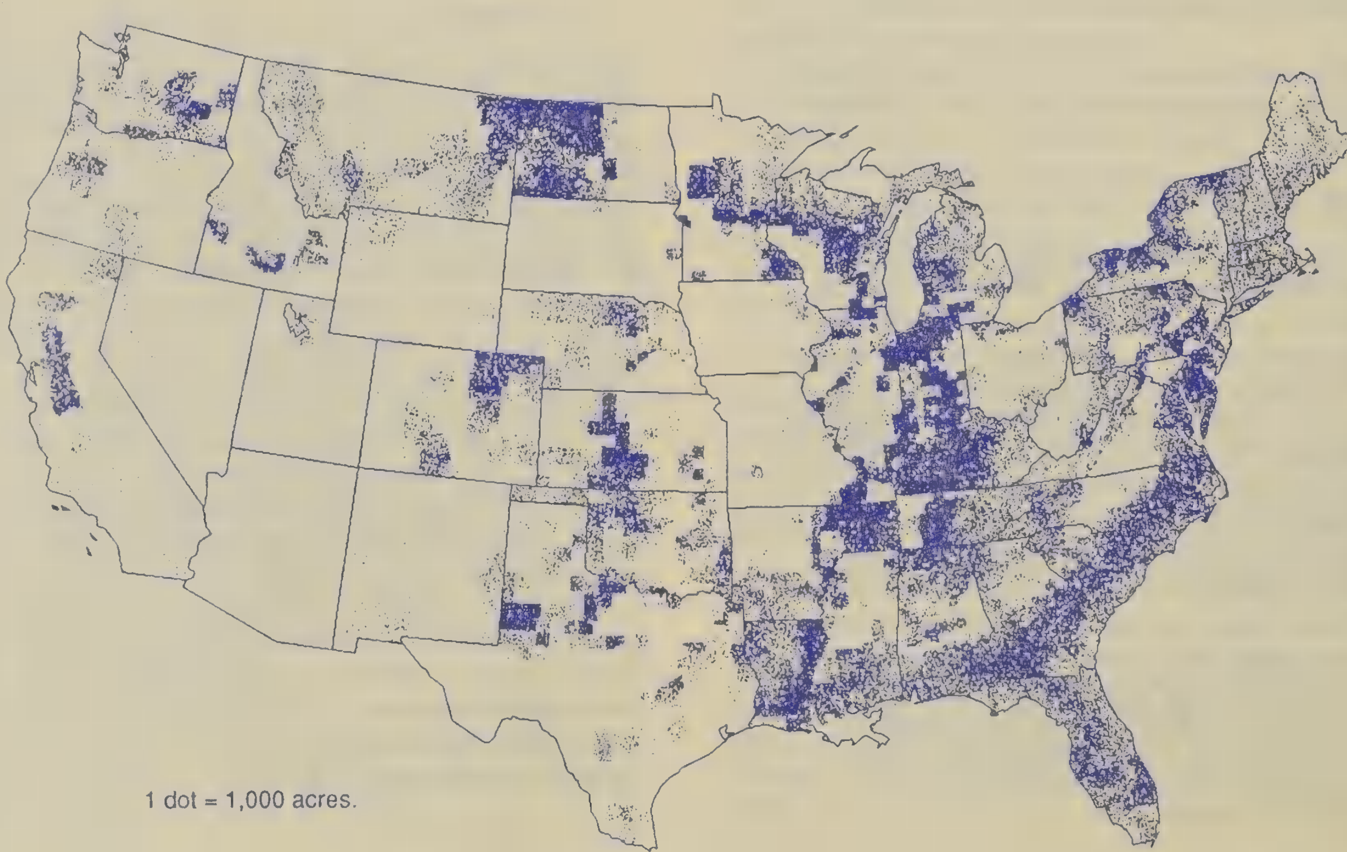
Although there is still much to be learned about the movement and fate of agricultural chemicals in ground water, ERS researchers have applied some already known relationships to measure the likelihood of ground water contamination from nitrogen fertilizer and applied pesticides. A composite measurement, called the DRASTIC score, helps to identify resource conditions under which the potential for nutrient and chemicals to leach into ground water is high (see box).

However, vulnerability, as represented by high DRASTIC scores, indicates only the existence of hydrogeologic features that increase the likelihood of ground water contamination if water-soluble pesticides and fertilizers are applied to the land. The use of leachable pesticides and fertilizers on vulnerable land (that is, land with a high DRASTIC score) creates conditions with the greatest probability for chemicals to leach into ground water.

Fig. A-1 shows the distribution of U.S. agricultural land vulnerable to ground water contamination as determined by the DRASTIC score. The Southeast encompasses a large percentage of U.S. agricultural land potentially vulnerable to contamination. The hydrogeology of this region, particularly Florida, is dominated by shallow, porous limestone aquifers overlain by thin, sandy soils. These factors, com-

Figure A-1

Agricultural Land Vulnerable to Ground Water Contamination



contamination. The hydrogeology of this region, particularly Florida, is dominated by shallow, porous limestone aquifers overlain by thin, sandy soils. These factors, combined with high annual rainfall, render the ground water in this region highly susceptible to fertilizer and pesticide leaching. In contrast, the Southern Plains and Mountain States have a relatively small percentage of vulnerable agricultural land. These regions typically have low rates of ground water recharge and deep, well protected aquifers.

Potential for Pesticide Contamination

One way to estimate the likelihood of pesticides leaching into ground water is to combine information on ground water vulnerability with that on pesticide movement and patterns of use. Those areas identified in fig. A-1 as being vulnerable to contamination were also evaluated on the basis of pesticide use, considering specifically those pesticides having highly leachable properties and therefore a greater chance of reaching ground water (fig. A-2).

Those areas susceptible to ground water contamination problems resulting from the use of leachable pesticides can now be identified. Fig. A-2 shows that the Corn Belt and Southeast have a large number of acres potentially at risk from pesticide leaching. While these data focus solely on the field use of pesticides, local incidents of chemical contamination can also arise from spills, careless mixing and rinsing of pesticides near wells, and back-siphoning into wells.

Potential for Nitrate Contamination

The presence of nitrates in ground water as a result of agricultural activity is a difficult problem to address. High nitrate concentrations in ground water can arise from a number of agricultural sources, including fertilizer use, livestock operations, irrigation, and cultivation of mineralized soils.

But nonagricultural sources of nitrates, such as septic tank drainage, land disposal of municipal and industrial wastes, and natural mineral deposits also contribute to ground water contamination. Given this variety of possible sources and pathways, it is difficult to pinpoint whether nitrates detected in an aquifer are the result of agricultural or nonagricultural activities, especially when these activities occur in the same or nearby locations (6).

While still far from adequate, monitoring procedures to determine the presence of nitrates in ground water are more widespread than those for pesticides, and the information collected through these procedures provides a good starting point for assessing the extent of the nitrate contamination

Figure A-2
Cropland Potentially at Risk from Pesticide Leaching

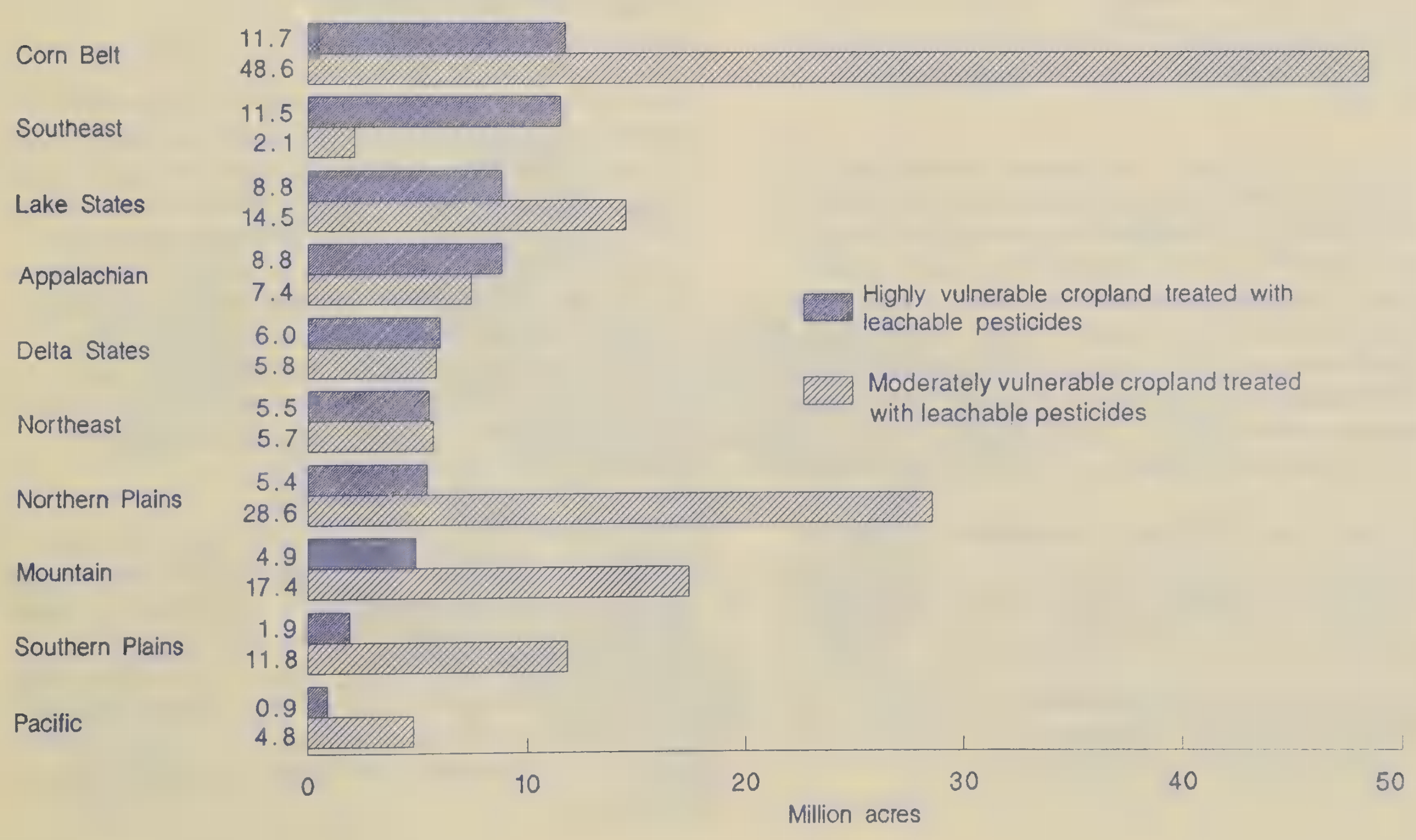
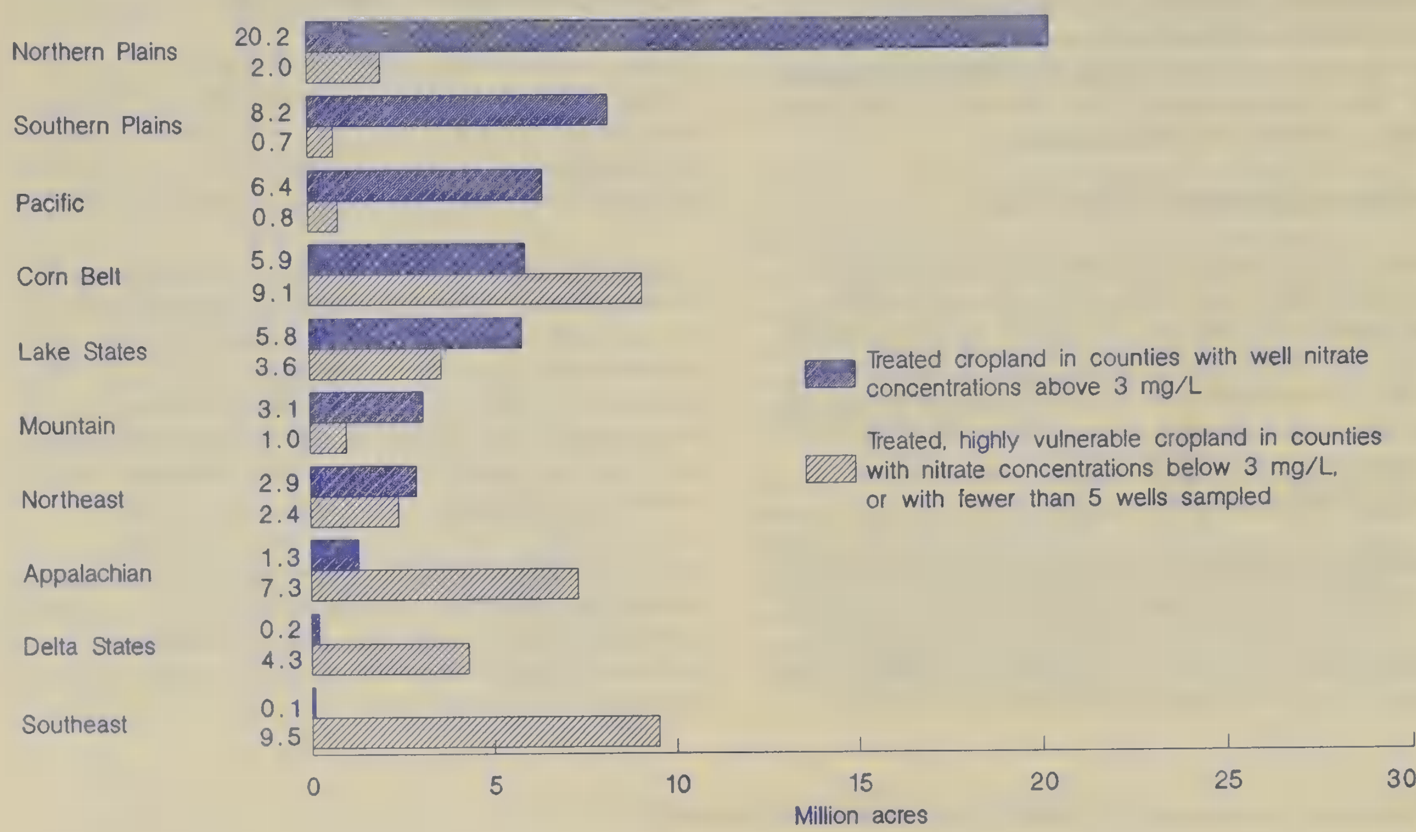


Figure A-3
Cropland Potentially at Risk from Nitrate Leaching



TIC scores) and nitrogen fertilizer use (7). Refinements in the calculation of DRASTIC scores have now made it possible to identify vulnerable areas by the number of acres affected.

To minimize the effect of other potential nitrate sources, non-agricultural counties were excluded from the analysis. Those agricultural counties with nitrate-nitrogen concentrations in ground water above normal background levels (3 milligrams per liter) were assumed to already have a high potential for nitrate contamination. Those counties where nitrate concentrations were below that level (or where well monitoring data were insufficient), but where nitrogen fertilizers are used and DRASTIC scores indicate the potential for nitrates to leach into ground water, were also included.

The result of this evaluation are presented in fig. A-3. The most noticeable areas of concern are the Northern and Southern Plains, where elevated nitrate levels have been detected in a number of wells. Although they do not have as high an occurrence of nitrate detections in wells, the Southeast, Corn Belt, and Appalachian regions demonstrate the potential for nitrate leaching, given the vulnerability of the cropland and the number of acres treated with fertilizers.

Agricultural Runoff Affects Surface Water Resources

Agricultural pollution contributes not only to ground water contamination, but to surface water quality problems as well. When runoff from cropland reaches lakes, streams, and estuaries, residues from nutrient applications, sediments, and pesticides can degrade water quality. Nutrients, particularly nitrogen and phosphorus, promote the growth of algae and the premature aging of lakes, streams, and estuaries (a process called eutrophication). Dissolved sediment harms aquatic life—reducing sunlight, smothering spawning grounds, and choking fish. Pesticide residues that reach surface water systems also harm freshwater and marine organisms.

The management of surface water quality problems caused by agricultural activities differs somewhat from the management of ground water contamination. For example, it is generally easier to monitor surface water for the presence of nutrients and pesticides. In addition, polluted surface water systems may be restored to higher quality through remedial and preventative actions; ground water, on the other hand, may remain contaminated once nitrates and pesticides enter the aquifer.

However, as is the case with many ground water quality problems, agricultural sources of surface water pollutants are generally spread over a wide area. These nonpoint pollution sources are more difficult to control, since a source cannot be positively linked to a degraded water body.

The Extent of the Surface Water Pollution Problem

To assess the significance of agricultural nonpoint source pollution in U.S. streams and lakes, a recent study calculated the delivery of nutrients and sediments to freshwater systems through agricultural runoff (9). Of 99 watersheds examined, 48 had excessive levels of nutrients or sediment. The study found agriculture to be a significant source of nitrogen pollution—that is, it contributed more than 50 percent to total pollutant discharge—in nine watersheds. Agriculture was a significant source of sediment in 34 watersheds, and of phosphorus in 31 watersheds (fig. A-4).

Another recent study identified the scope and significance of agricultural contributions to coastal water pollution (3). This study obtained data on quantities (loadings) of surface water pollutants from both point and nonpoint sources in 23 coastal States and 78 estuarine systems. Among the specific pollutants the study identified were nutrients (nitrogen and phosphorus), sediment, and pesticides.

For the 78 estuarine systems considered, agricultural runoff supplied, on average, 24 percent of total nutrient loadings and 40 percent of total sediment. Agriculture contributed more than 25 percent of total nutrients in 22 of 78 estuaries. Twenty-one systems demonstrated high rates of pesticide losses to surface water; 15 systems showed both significant agricultural nutrients and high pesticide losses (fig. A-5).

Water Quality Problems from Agricultural Sources Are Costly for Water Users

When water resources are polluted by agricultural chemicals and sediment, society pays the price. The economic losses from impaired water quality can take a number of forms, including the cost of providing alternative sources of drinking water, the expense of increasing treatment for public and private water systems, lost recreational opportunities, and damage to recreational and commercial fishery resources.

One study has analyzed the costs which could be incurred by consumers to avoid drinking water which may contain agricultural chemicals (7). The study used a "damage avoided" approach to estimate the costs society would have to pay to reduce the risk of exposure by measuring the avoidance costs (the costs of monitoring private and public wells for the presence of pesticides and nitrates). The study determined that costs to monitor private systems drawing on ground water would range from $890 million to $2.2 billion

Figure A-4

Watersheds Having High Agricultural Nonpoint Source Pollution

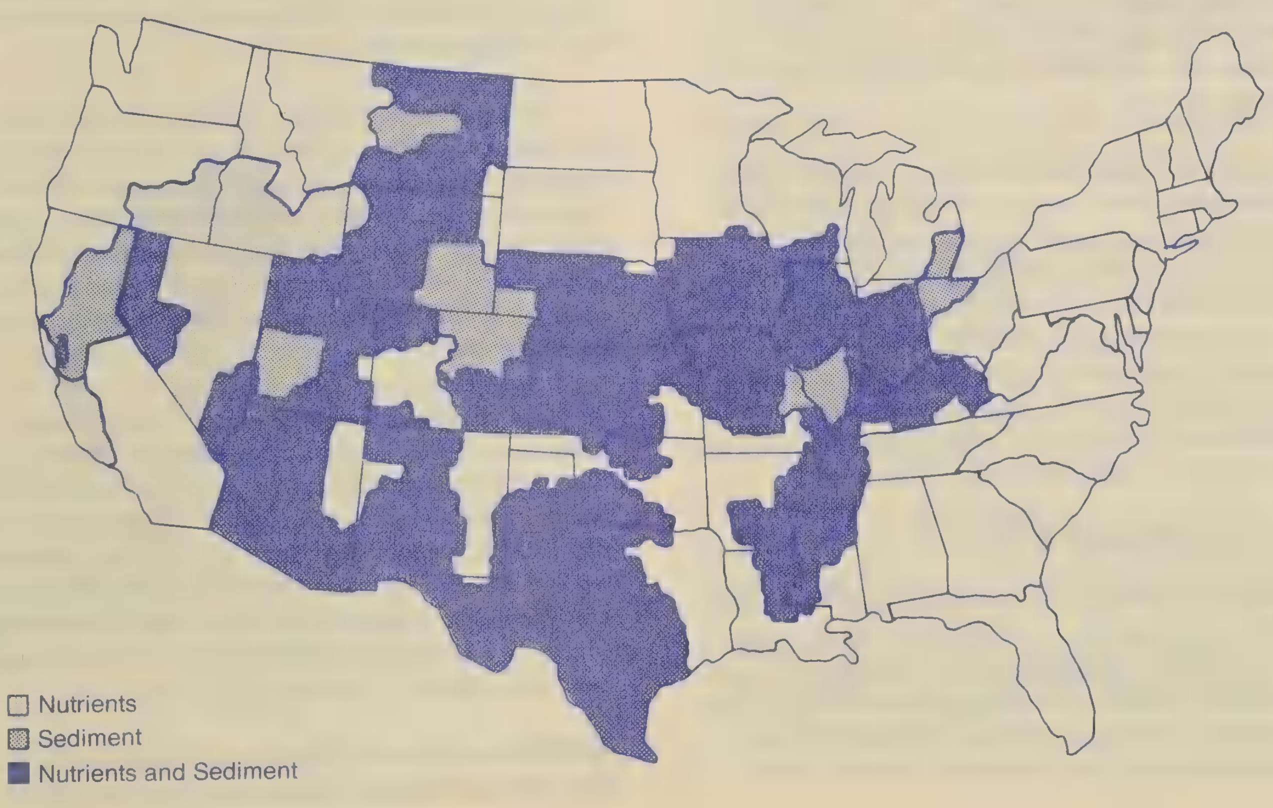
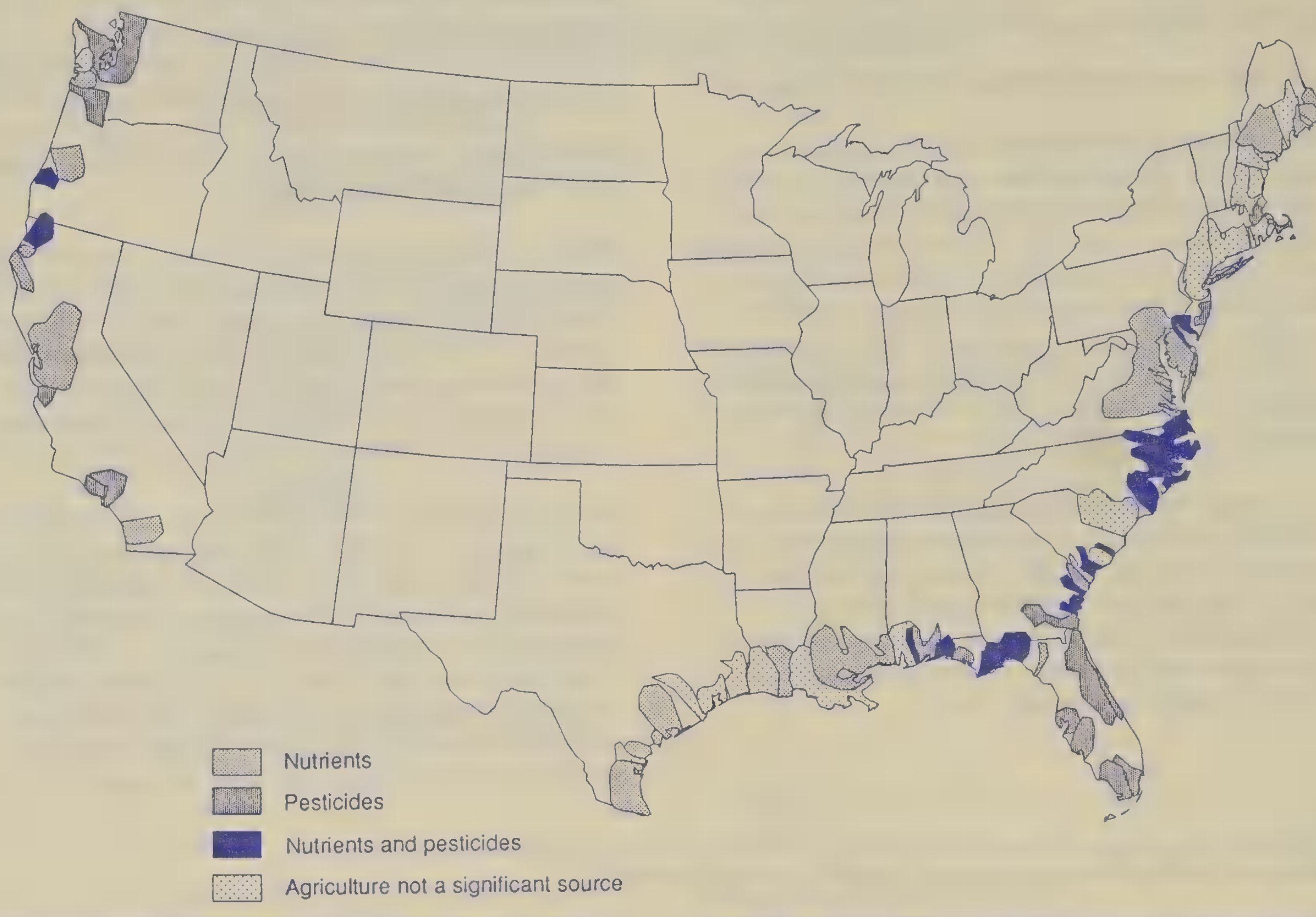


Figure A-5
Agricultural Nonpoint Source Pollution of Coastal and Estuarine Waters



a year; costs to monitor public systems drawing on ground water may total roughly $14 million. The costs for public wells were much smaller than those for private wells because one public system can serve many times more people than a private well.

Several studies have estimated the costs of nonpoint source pollution of surface water. One study estimates the cost of impaired water quality from soil erosion at $5-$18 billion per year (10). These annual costs consist primarily of damages to: freshwater fishing, boating, and recreation ($2.1 billion per year); municipal and industrial water uses ($1.2 billion); water storage facilities ($1.1 billion); municipal treatment plants ($1.0 billion); navigable waterways, primarily from silting and requirements for dredging ($750 million); and commercial fishing ($450 million).

Outlook and Conclusions

The renewed focus on the water quality problem has particular significance for agriculture. Federal policymakers are shifting their emphasis from traditional protection of cropland productivity through soil conservation to a broader strategy that explores and attempts to minimize the off-farm water degradation caused by agricultural activities. President Bush's new Water Quality Initiative is designed to allocate additional resources into research, extension services, and technical assistance for the problem.

USDA and other Federal agencies have long stressed the importance of voluntary programs and a cooperative approach involving both private landowners and Federal, State, and local agencies to address the nonpoint source pollution problem. Policies currently being considered at the national level are often based on education and technical assistance to farmers to promote environmentally sound production practices.

Several proposals have been put forth to include water quality concerns in legislation following the 1985 Food Security Act. One such proposal would expand the Conservation Reserve Program (CRP) and target it to water quality problems by including in the program land with ground water, overall water quality, pesticide, residue, and soil salinity problems. Other proposals would amend CRP eligibility to include land for the specific purpose of protecting ground water and other environmental objectives.

Modifications in the compliance requirements for commodity program participants could also affect water quality. A

Wellbusters program similar to the current Sodbuster and Swampbuster provisions would extend the compliance requirement to cover cropland overlying vulnerable ground water aquifers. Under this proposal, farmers who engage in farm management practices that increase the risk of ground water contamination would forfeit their Federal farm program benefits.

Expanding the CRP program to improve or preserve water quality may pose a problem for policymakers. Cropland currently eligible for the CRP is not always located in areas with potential ground water problems. As can be seen from fig. 18, the Southeast, identified earlier as susceptible to pesticide and nitrate residues reaching ground water, has comparatively little cropland currently eligible for CRP enrollment. Eligibility rules would have to be amended to bring these environmentally sensitive lands into the program.

In those regions having both currently eligible and environmentally sensitive cropland, such as the Corn Belt, it may also be necessary to raise CRP rental rates to encourage farmers to enroll additional acreage for water quality reasons (a course that would increase program costs, and fuel a criticism already being leveled at the CRP). Also, enrolling environmentally sensitive acreage in the CRP is a temporary, not permanent, solution to water quality problems. New provisions, such as permanent easements, must be implemented to protect sensitive areas beyond the term of the CRP.

What impacts these programs will have on U.S. agriculture and on water quality depend on a number of factors. If incentives for compliance with water quality programs and penalties for noncompliance are tied to Federal commodity program participation, the programs will be truly effective only in those areas with high participation rates.

For example, the effectiveness of a Wellbusters program would depend on whether its compliance costs (required treatment or adjustments in farming practices) are lower than Federal commodity program benefits. Accordingly, the difference between market and target prices would greatly influence the program's effectiveness.

Finally, much of the response to concerns about water quality problems relating to agriculture and nonpoint sources has come at the State and local level. Many of these water quality problems, particularly ground water contamination, are very localized and therefore often defy national solutions. Many States have enacted or are considering legislation and policies to deal with water quality concerns (see the conservation section of the report). At the Federal level, much of the effort to improve and safeguard water quality will be directed toward helping States and local communities design solutions to their particular problems.

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From the 1985 Farm Bill to 1990 and Beyond: The Resource Effects of Commodity Programs

by

Robbin Shoemaker, Margot Anderson, and James Hrubovcak*

Abstract: Changes in agricultural commodity programs and environmental policies can significantly affect the use and value of agricultural resources. Current trends toward greater market orientation and increased conservation provisions can produce long-term environmental benefits.

Keywords: Commodity policy, environmental policy, soil erosion, water quality.

Introduction

In the mid-1980's, the farm sector has been adjusting to more market oriented agricultural policies. The high cost of farm programs and efforts to promote freer trade led to reduced loan rates and target prices in the 1985 Food Security Act (FSA). The FSA also included several environmental and conservation provisions, such as the Conservation Compliance, Swampbuster, and Sodbuster provisions and the Conservation Reserve Program (CRP), designed to reduce soil erosion and surface water problems.

Continued efforts to reduce commodity support prices and revise acreage reduction programs will affect commodity prices, output levels, and the use and value of agricultural resources. A reduction in support levels will also lessen the effectiveness of the Conservation Compliance, Swampbuster, and Sodbuster provisions, increasing some potential environmental problems while possibly alleviating others.

In this paper we present estimates of the resource and environmental effects of removing price and income support programs and land diversion requirements. We discuss how the net change in resource use and value depends on the mix of crops produced, the level of output, the location of production, and commodity price adjustments.

Agricultural Policies Affect Resources and Values

The objectives of agricultural policy include supporting prices, supplementing income, managing supply, and addressing environmental concerns. Some of the policy instruments used to meet these objectives include nonrecourse loans, grain reserves, target prices, and land diversion or retirement programs such as the acreage reduction program (ARP), paid land diversion (PLD), and the CRP.

Agricultural policies that support commodity prices raise the price of crops that are eligible to receive program benefits (program crops) relative to the price of nonprogram crops. Prior to the enactment of the FSA in 1985, commodity program benefits were tied to base acreage yields. This provided incentives for farmers to plant program crops and increase program crop yields. Because program crops are frequently more erosive and more input intensive than nonprogram crops, increased program crop production can increase soil erosion and nonpoint source residuals (1).

Land retirement programs result in the underutilization of land, forcing farmers to spread fixed costs across less output, thus reducing production efficiency. Current base acreage requirements, which are used to compute program benefits, encourage specialization in one or a few crops. These requirements discourage diversification into nonprogram crops and can contribute to soil erosion, increased pest populations, and increased chemical use.

The financial benefits producers receive from commodity programs are largely reflected in higher land values. Although price supports boost farm income in the short run, the increase in income gradually erodes as the farm sector adjusts to the higher level of Government support. Because land is a relatively fixed factor, program benefits are partially incorporated into land values, which exceed the amount the land would be worth in the absence of Government programs.

Impacts of Removing Commodity Policies

What might the farm sector look like if Government support declines? To illustrate the impact of reducing Government support, we examine the most extreme case of total commodity program elimination. We estimate the effect of removing price and income support programs and land diversion requirements (except the CRP).[1] We examine the short- and long-run effects of policy elimination on agricultural

* Agricultural economists, Economic Research Service, USDA.

1. Estimates are derived from a long-run computable general equilibrium model of the U.S. economy, and an intermediate-run model of the U.S. farm sector.

resources and the environment, and discuss the key factors that determine the outcomes.

Short-Run Effects of Policy Elimination

In the short run, eliminating support payments and acreage reduction requirements creates two production effects that work in opposite directions. The removal of price supports lowers the incentive price of program commodities (the price at which commodities are exchanged plus the Government payment) relative to nonprogram crops, thus providing the motivation to reduce production.

On the other hand, increased availability of land, released from set-aside programs, provides the potential for greater output. The net result depends, in part, on the relative strengths of the two effects.

Resource and Environmental Effects

Our estimates indicate that in the short run, corn and cotton production decrease in response to lower incentive prices, while wheat and soybean production expand due to increased land availability. Although price supports for wheat also fall, the limited production alternatives in wheat-producing regions result in greater wheat production on former ARP land.

The environmental impacts of eliminating commodity policies depend in part on changes in the use of agricultural chemicals. Estimated fertilizer and pesticide use remains relatively unchanged for the United States, although there is some change among regions due to regional shifts in crop production (figs. B-1 and B-2).

For example, fertilizer and pesticide use in the Southern Plains increases significantly due to a rise in total crop production. Corn production in this region falls, but the greater wheat and soybean production increases the demand for fertilizers and pesticides.

In the Delta States, however, total chemical use declines because soybeans replace corn and cotton production. In the Corn Belt, pesticide and fertilizer use decrease marginally because a rise in soybean production offsets the decline in corn production.

Changes in crop production also affect ground water quality and soil erosion. Such a relatively large decline in chemical use in the Delta States may improve this region's water quality. At the same time, the large increase in chemical use in the Southern Plains could harm water quality. The water quality in any region depends not only on the level of chemical use, but also on the water supply's vulnerability to contamination, which is affected by soil type and hydrogeologic factors.

Figure B-1
Estimated Percentage Change in Fertilizer Use Without Farm Programs

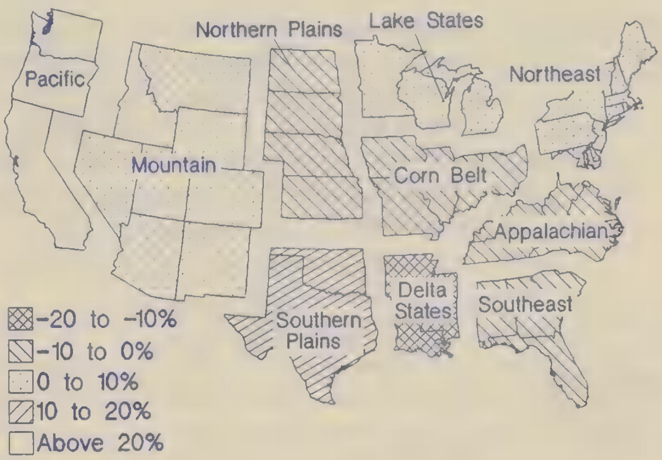
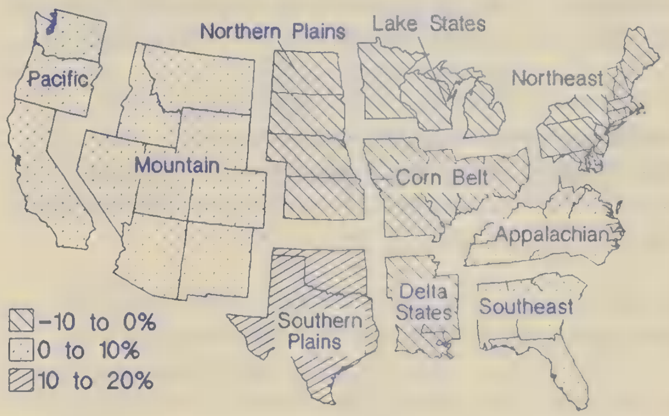


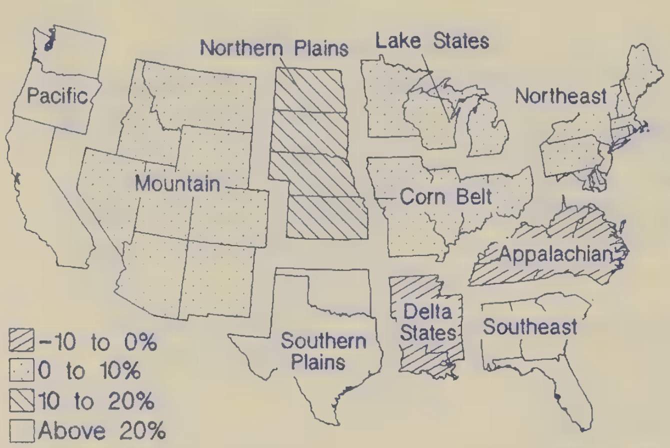
Figure B-2
Estimated Percentage Change in Pesticide Use Without Farm Programs



Total soil erosion in the United States increases in the range of 5-10 percent; regionally, the percentage change in soil erosion varies considerably (fig. B-3). The Pacific, Southern Plains, and Southeast demonstrate the largest increase in soil erosion. This increase can be attributed to expansion in total crop acreage in the absence of commodity programs.

Changes in commodity policy that result in the removal of base requirements can, in the longer run, improve the environment. Removing base requirements may shift production away from program crops (such as corn, which relies more on pesticide and fertilizer use) toward nonprogram crops. Encouraging greater flexibility in crop production will allow more crop diversification, which can reduce soil erosion and increase soil fertility. Diversification will also break pest cycles, thereby reducing pesticide use. At the same time, the elimination of commodity programs may increase soil erosion in some areas if highly erodible land is brought back into production.

Figure B-3
Estimated Percentage Change in Erosion Without Farm Programs



Long-Run Effects of Eliminating Commodity Policies

In the long run, the elimination of commodity programs will enable farmers to respond to more market-oriented price signals. In the short run, increased wheat and soybean output will likely put downward pressure on the prices of these commodities, forcing some resource adjustments in the sector.

After farmers have adjusted, program crop production will likely decrease and crop prices will consequently rise. On the other hand, production of nonprogram crops will likely increase, reducing the prices of these commodities as production shifts from program to nonprogram crops.

An overall decrease in the total use of variable inputs is expected as crop production declines over the long term. A reduction in overall chemical use, coupled with acreage increases, reduces chemical use per acre. The decline in the use of fertilizers and pesticides could improve water quality as fewer total chemical residuals enter the environment. Although total chemical use may be lower, the environmental impacts will differ depending on the level of chemical use, the amount of land brought back into production, and regional geographic characteristics.

The total amount of resources in the agricultural sector will likely decline. Initially, the declining returns to labor and capital encourage adjustments in the sector. Over time, labor may move to other sectors of the economy, and declining net capital investment may reduce the amount of capital in the sector. The labor and capital remaining in the sector will likely earn a rate of return comparable to that of other sectors in the economy.

Land Values Will Likely Fall

The removal of commodity programs will decrease land values, all other things being equal. Land values represent the present value of the expected net returns to agricultural production. Reducing or eliminating support programs reduces expected future returns and therefore land values.

The magnitude of the fall in land prices depends on the extent to which current land values reflect the expectation of continued Government commodity programs. From 1982 to 1987, direct Government payments represented 34 percent of net farm income, on average. The decline in land values may be overstated if landowners perceive support levels to be declining (these levels have been falling since 1985). With the perception of declining price support levels, less income support is capitalized in land values.

Substitution Among Inputs Lessens Impact

The degree to which farmers can change production patterns by substituting land for other inputs will determine the overall impact of commodity policies on input use, output, and land values. For example, limited opportunities for input substitution with increased land availability imply little change in the mix of inputs. With limited substitution possibilities, farm output and input use increase as ARP land is brought back into production. Given relatively stable demand, commodity prices would fall. On the other hand, greater substitution possibilities allow farmers to change production practices and vary the amount and mix of inputs used. With greater substitution possibilities, additional land brought back into production results in modest production increases that offset the decline in commodity prices.

Environmental Policy

The 1985 FSA tied conservation provisions to commodity programs through the Conservation Compliance, Sodbuster, and Swampbuster provisions. These provisions constitute important tools in achieving environmental goals. Producers will have little incentive to participate in these conservation programs if commodity support is eliminated. Additional legislation may therefore be needed to achieve environmental goals.

Overall public policy can address environmental problems that are created within the agricultural sector. Some suggestions for achieving environmental goals involve expanding current conservation policies, divorcing conservation policies from commodity policies, and exploring new conservation policies.[2] These options include expanding long-term land retirement programs, targeting conservation programs increase their benefits, and providing incentives for low-input agriculture.

2. For example, Senator Fowler's low-input agriculture bill (S. 2898) and Senator Lugar's Conservation Enhancement and Improvement Act of 1989 (S. 1063).

For example, some groups have advocated an increase in CRP acreage to reduce soil erosion and achieve other environmental targets (2). It is possible to target fragile areas by encouraging CRP enrollment through higher payments for the most erodible land. The expanded CRP could include provisions requiring additional conservation practices, such as improving water quality or tree cover in targeted areas. At the same time, an increase in CRP acreage would be costly to administer and could reduce agricultural production and commodity exports.

Other conservation proposals include providing cost-sharing and technical assistance to farmers for maintaining water quality and adopting practices that are sensitive to environmental concerns.

Of course, agricultural and environmental policy choices involve tradeoffs. Environmentally oriented farm legislation can lead to decreased yields, greater production costs, and higher food costs. On the other hand, environmentally oriented legislation can help provide a safer food supply, and maintain the integrity of our natural resources.

Conclusions

Although agricultural policy has shown a distinct market orientation since 1985, environmental considerations also play a major role in shaping policy. A decline in Government support would reduce the effectiveness of environmental provisions that have been tied to commodity programs. To understand the impact of a continuation of these trends on agriculture, we provide some estimates of the resource and environmental effects of removing commodity policies.

Continued changes in agricultural policy could reduce commodity support prices and the amount of land idled under acreage reduction programs. The resulting effects on commodity prices and output would alter both the use and value of agricultural resources. In the short run, the removal of supply controls would bring additional acreage into production. Any changes that occur in input use, soil erosion, and water quality depend on the crop mix, location of production, and the commodity price adjustments.

In the long run, the estimates suggest that total input use could remain relatively constant over a larger acreage base. The removal of target prices would revalue assets, affect technological change, and stimulate longer-term adjustments of agricultural land, structures and machinery, and owner-operator labor.

References

1. Miranowski, J. and K. Reichelderfer. "Resource Conservation Programs in the Farm Policy Arena." *Agricultural Food Policy Review: Commodity Program Perspectives*, U.S. Dept. of Agr. AER No. 530, July, 1985.

2. Phipps, T. and K. Reichelderfer. "Farm Support and Environmental Quality at Odds?" *Resources for the Future*. Spring, 1989. No. 95.

List of Tables

Recent Updates in Farmland Values

In an August 1989 survey, a national panel of 485 accredited rural appraisers provided information on recent and anticipated changes in farmland values. Their responses pertained to their own local areas, but were weighted to form national and four regional estimates.

The majority of appraisers reported that prices for farmland have not changed recently. However, those reporting increases outnumber those reporting decreases. At the national level, 27 percent of the appraisers reported a rise in land values over the previous 3 months, 69 percent reported no change, and 4 percent reported a decrease. The distribution of directional changes that appraisers observed can be compared with the changes they forecast 3 months ago. In the May survey, 24 percent expected higher values, 75 percent expected no change, and 1 percent expected a decrease. The appraisers' recent experience with the direction of price change resembles their forecasts.

From the May survey, appraisers forecast a 0.6-percent increase during May-July. Three months later, they reported a 1.4-percent increase during this period. Both the North Central and Southern regions reported the largest gains, each averaging 1.6 percent. The Northeast and the Western regions averaged less than 1 percent.

Over the year ending August 1989, 71 percent of the appraisers reported an increase in land values, 25 percent reported no change, and 4 percent reported a decline. The average change for the August 1988-August 1989 year was reported to be 6.4 percent. Appraisers in the North Central region indicated the largest increase—9.5 percent; the Southern region indicated the smallest increase—2.8 percent.

The most frequently cited reason for the increases over the previous 3 months was increasing commodity prices. The appraisers also noted that expansion demand and overall farmland demand had increased. When asked why the increase over the previous year had occurred, the appraisers added the improved outlook for the general economy to their list of causal factors.

The appraisers were again asked to make forecasts. Over the August-October 1989 period, 28 percent expect an increase, 67 percent expect no change, and 5 percent expect a decrease. Overall, the forecast increase in values is 0.7 percent. Looking ahead for the year beginning in August 1989, 64 percent of the appraisers expect prices to increase, 32 percent expect no change, and 5 percent expect a decrease. The average expected increase is 3.5 percent. Relatively larger increases of 4.7 percent are expected for the North Central region, while the smallest increases are expected for the Northeast, at 1.4 percent. The most important reason given for the increase in both periods is anticipated increases in commodity prices.

More information on farmland values is available in an earlier report, *Agricultural Resources: Agricultural Land Values and Markets Situation and Outlook*, AR-14, which may be obtained by calling 1-800-999-6779.

Definitions

Acreage Reduction Programs—A voluntary land retirement program in which farmers reduce their planted acreage to become eligible for deficiency payments, loan programs, and other USDA farm program benefits.

0/92 Provision—An optional, Federal acreage diversion program which allows wheat and feed grain producers to devote all or a portion of their permitted acreage to conserving uses and receive deficiency payments on idled acreage exceeding 8 percent of the permitted acreage. Thus the maximum conserving use acreage that may receive deficiency payments is 92 percent of the permitted acreage. The deficiency payment rate will not be less than the projected deficiency payment for the crop. Production of alternate crops is not permitted on the conserving use acreage.

50/92 Provision—An optional, Federal acreage diversion program which allows cotton and rice producers who plant at least 50 percent of their permitted acreage to devote the remaining acreage to conserving use and receive deficiency payments on the idled acreage which exceeds 8 percent of the permitted acreage. Thus the maximum conserving use acreage that may receive deficiency payments is 42 percent of the permitted acreage. The deficiency payment rate will not be less than the projected deficiency payment for the crop. The production of alternate crops is not permitted.

Base acres—For wheat, feed grain, upland cotton, and rice, the average of acres planted and considered planted to the crop for harvest during the 5 preceding years. When a commodity acreage reduction program is in effect, a farmer's planted acreage cannot exceed the base acres and be eligible for deficiency payments, loan programs, and other USDA program benefits, except in special cases (such as modified contracts).

County Constrained Acreage—Maximum acreage in a county which can be enrolled in the Conservation Reserve Program. Counties are constrained to enroll no more than 25 percent of their total cropland into the program except when a special USDA waiver is given to the county.

Cropland used for crops—Cropland harvested, crop failure, and cultivated summer fallow.

Cropland harvested—Acreage on which intertilled and closely sown crops, tree fruits, small fruits, planted tree nuts, and hay are harvested.

Crop failure—Mainly acreage on which crops failed because of weather, insects, and diseases, but includes some land not harvested due to lack of labor, low market prices, or other factors. It excludes acreage planted to cover and soil improvement crops not intended for harvest.

Cultivated summer fallow—Cropland in subhumid regions of the West cultivated for a season or more to control weeds and accumulate moisture before small grains are planted. Other types of fallow, such as cropland planted to soil improvement crops but not harvested and cropland left idle all year, are excluded.

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